DOCUMENT RESUME

ED 052 609 EM 009 063

TITLE	BASIC Simulation Programs; Volumes V and VI. Social Studies, Teacher Assistance.
INSTITUTION	Brooklyn Polytechnic Inst., N.Y.; Digital Equipment Corp., Maynard, Mass.
SPONS AGENCY	National Science Foundation, Washington, D.C.
PUB DATE	31 Jan 71
NOTE	69p.; Developed by the Huntington Computer Project
AVAILABLE FROM	Digital Equipment Corporation, Educational Marketing (5-2), 146 Main Street, Maynard, Massachusetts 01754 ($3.00)
EDRS PRICE	EDRS Price MF-$0.65 HC Not Available from EDRS.
DESCRIPTORS	Class Average, *Computer Assisted Instruction, *Computer Programs, Concept Teaching, *Economics, *Grading, *Item Analysis, Manuals, Measurement, Program Descriptions, Social Studies, Teaching Guides

ABSTRACT

Five computer programs which teach concepts and processes related to social studies (in the main, economics) are presented. The subjects of the programs are the distinction between balance of trade and balance of payments; installment buying, loan payments, and savings accounts; flow of goods, services, and money between business and the consumer; economic depression and equilibrium; and the stock market. For each lesson the objectives, necessary preliminary preparation, knowledge prerequisites, ways to use the problem, the computer program, and a sample printout are provided. The programs are suitable for use at the high school level. The volume also contains several programs to help the teacher compute and analyze students' grades. These programs average grades, print frequency distributions, and analyze the items missed most frequently. All programs are written in the language BASIC. (JK)

ED052609

EM009063

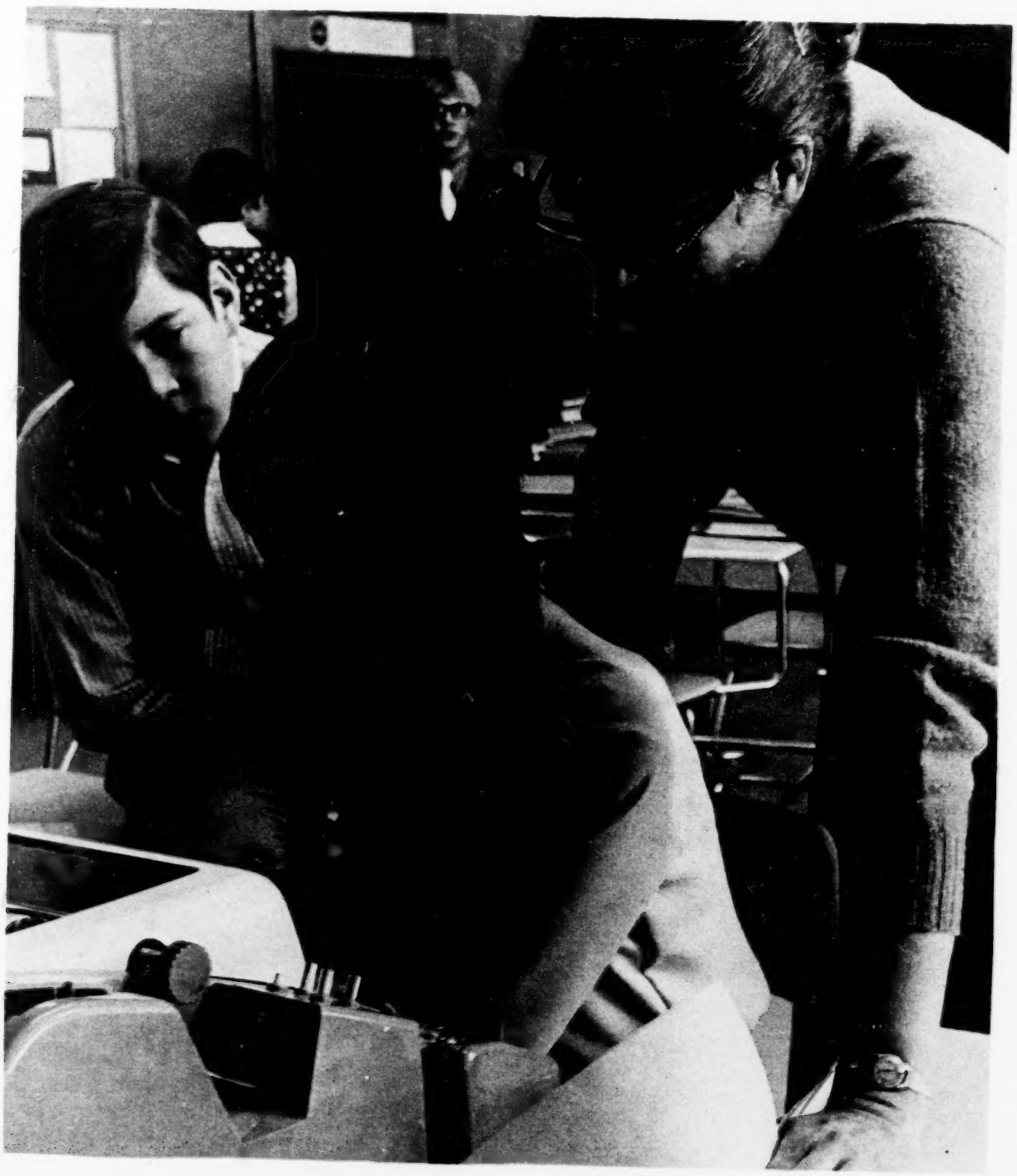
DIGITAL EQUIPMENT CORPORATION

education

Basic Simulation Programs

Volumes V & VI

Social Studies
Teacher Assistance



ED052609

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

PROCESS WITH MICROFICHE AND PUBLISHER'S PRICES. MICROFICHE REPRODUCTION ONLY.

HUNTINGTON COMPUTER PROJECT

A TEACHER'S MANUAL

(COMPUTER - RELATED MATERIALS)

Second Edition

January 31, 1971

Director: Dr. Ludwig Braun
Assistant Director: Dr. Marian Visich, Jr.

Polytechnic Institute of Brooklyn
333 Jay Street
Brooklyn, New York 11201

Developed by the Huntington Computer Project during the period May, 1968 and September, 1970. This effort was supported by the National Science Foundation under Grant No. J000079.

"PERMISSION TO REPRODUCE THIS COPYRIGHTED MATERIAL BY MICROFICHE ONLY HAS BEEN GRANTED BY
David H. Ahl
Digital Equip. Corp.
TO ERIC AND ORGANIZATIONS OPERATING UNDER AGREEMENTS WITH THE U.S. OFFICE OF EDUCATION. FURTHER REPRODUCTION OUTSIDE THE ERIC SYSTEM REQUIRES PERMISSION OF THE COPYRIGHT OWNER."

© Copyright 1971, Polytechnic Institute of Brooklyn

The enclosed material is a compilation of computer programs developed during the period May, 1968 to September, 1970. These programs were developed by teachers and students in the high schools which participated with us, and by the Project staff.

All of the enclosed programs have been tested on a Digital Equipment Corporation TSS-8 time-shared computer during the summer of 1970. To the best of our ability, we have assured ourselves that the programs actually run. It should be pointed out, however, that we were not able to make an exhaustive exploration of the programs. There may be undiscovered bugs (if there aren't, it may be the first time in the history of computing). We would appreciate hearing of any which emerge in the future.

These programs run in the version of BASIC which existed on the TSS-8 in August, 1970, and should run on most other versions of BASIC. The major potential problem on other machines is the output format (DEC uses 14 columns per print zone, while some other manufacturers use 15; we used the TAB function, which doesn't exist in all BASIC compiles). It may be necessary to make some minor changes in programs to adjust this format. Another possible problem is in the use of the RANDOMIZE command in some programs to start the random-number generator at a random point. If this command is not available, some other means should be devised for randomizing the start.

It is our sincere hope that these programs and their supporting documentation will be helpful to educators who are exploring the uses of computers in education.

We are anxious to hear of any bugs, errors, or improvements in these programs, and are especially anxious to hear of any novel ways of using them.

Ludwig Braun
Marian Visich, Jr.

TABLE OF CONTENTS

Volume I

BIOLOGY

DROS 1
Game approach to determination of the genetic characteristics of Drosophila.

EVOLU 7
Simulated experiment - The relationship between evolution and natural selection is accomplished by studying a population of mutant moths.

GAMGN 14
Review of gametogenesis using diagrams and questions.

MEMBR 20
Experiment simulation showing the active and passive transport of materials across a membrane.

NZYMC 25
Simulated experiment - Degree of enzyme reactivity varies as environmental conditions are changed.

NZYM2 32
Simulated experiment - Maximum enzyme reactivity is shown as being dependent upon an interaction of environmental conditions.

PHOSYN 38
Simulated experiment - Photosynthetic production of sugar varies as student varies light intensity or carbon dioxide concentration.

EARTH SCIENCE

CLIMAT 45
Practice in identifying climates and climatic patterns.

CLOUDS 54
Explores problems related to the formation of cumuliform clouds.

WATER1 60
A tutorial program which goes through the calculations of a water budget.

WATER2 67
Prints out a complete water budget.

Volume II

CHEMISTRY

ATWT 1
Calculates atomic weight from percent abundance of isotopes.

AVOGA 4
Calculates Avogadro's number.

DECAY1 7
Radioactive decay is treated qualitatively in a game-type situation.

DECAY2 11
Calculates half-life, mass and prints a table showing mass or number of particles of a radioactive sample.

EMPIR 18
Calculates empirical formulas.

EQUIL1, EQUIL2 21
Calculates the effects of concentration changes in the equilibrium systems: $2HI \rightleftharpoons H_2 + I_2$ and $PCl_5 \rightleftharpoons PCl_3 + Cl_2$.

KINET 28
Tabulates and graphs equilibrium concentration data.

MASSD 34
Calculates mass defect.

MOLAR 38
Calculates molarity from titration data.

PHPOH 41
Calculates pH, pOH, and percent dissociation.

PRCNT 44
Calculates percent composition.

STOICH 48
Solves mass/mass, mass/volume, and volume/volume problems.

Volume III

MATHEMATICS

ARITH
Review of multiplication skills. (General Math) 1

BANK
Solves financial problems concerning installment buying, long term loans, and savings accounts. 5

CRVLEN
Computes the length of any curve. (analytically defined) 10

CVAREA
Computes the area under any curve. (analytically defined) 13

GCD
Finds the greatest common divisor of any set of numbers. 18

LIMSIN
Evaluates the limit of sin x/x as x approaches zero, in both radian and degree measure. 21

PI2
Computes the area of a circle using both inscribed and circumscribed regular polygons. 25

PLOTTR
Plots the graph of any function. 29

PRIFA
Finds prime factors. 37

QUADRT
Describes the graph of the second-degree equation, $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$. 40

RATIO
Solves for the unknown in a proportion. 43

ROOTS2
Finds the real roots of the quadratic equation $ax^2 + bx + c = 0$. 46

SETS
Finds the union and intersection of any two numerical sets. 49

MATHEMATICS (con't)

SIMEQN 53
Finds solutions to sets of up to ten simultaneous equations.

SLOPE 58
Computes the tangent slope for any function.

SQRT 62
Finds the square root of counting numbers up to five decimal places.

STATAL 65
Calculates the arithmetic mean (average) of a set of numbers.

STOCK 69
Simulates the stock market.

SURFAR 80
Computes the area of any surface of revolution.

VOLSOL 83
Finds the volume of solids of revolution.

Volume IV

PHYSICS

BFIELD 1
A plot routine illustrating the B field about one and two wire currents. (Electricity and Magnetism)

BOHR 8
Hydrogen line spectrum and energy level diagrams are displayed. (Atomic and Nuclear)

CALORI 15
Calorimetry experiment to determine the heat energy to be supplied (or removed) from each mass to obtain the equilibrium temperature. (Mechanics)

DECAY1 18
Radioactive decay is treated qualitatively in a game-type situation.

DECAY2 22
Calculates half-life, mass and prints a table showing mass or number of particles of a radioactive sample.

EFIELD 29
An extension of Coulomb's law. Finds the relative field strength at a distance from a line and plane of charge. (Electricity and Magnetism)

KINERV 36
Review of kinematics: presents questions concerning the movement of a ball in flight. (Mechanics)

LENSES 39
Solves lens problems. (Light and Waves)

MASSD 44
Calculates mass defect.

NEWTN2 48
A problematic situation requiring repeated application of Newton's second law. (Mechanics)

PHOTEL 52
Critical wavelength for photoelectric emission is to be determined in a simulated experiment. (Atomic and Nuclear)

PHYSICS (con't)

PHOTON 57
How energy levels are determined from the emissions of excited atoms. (Atomic and Nuclear)

PLANK 61
A photoelectric simulation. Students adjust the retarding potential to determine the wavelength of randomly selected electron emitting X-rays. (Atomic and Nuclear)

PRJTL 68
Coordinates and speeds are printed for a projectile fired at selected speeds and angles (frictionless). (Mechanics)

REFLCT 72
Least time principle of light is presented as a challenge involving a game analogy. (Light and Waves)

SLITS 76
A plot routine permitting further exploration of Young's Double-Slit experiment. (Light and Waves)

SNELL 92
A plot routine to aid in visualizing Snell's law. (Light and Waves)

SPACE 100
Demonstrates the effects of changing velocity on orbital motion. (Mechanics)

VFIELD 105
Plots a picture of the relative potential strength in the region surrounding two charges. (Electricity and Magnetism)

VLOCTY 110
Demonstrates that average velocity ($\Delta D/\Delta T$) approaches a limiting value as $\Delta T \to 0$. A graph of D vs. T is plotted for an acceleration of 1 meter/sec^2. (Mechanics)

WAVES 115
Plots a graph of a fixed and a variable wave, and the superposition of the waves. (Light and Waves)

Volume V

SOCIAL STUDIES

BALANC 1
Simulates the effects of the relationship between costs of production and revenues.

BANK 4
Solves financial problems concerning installment buying, long term loans, and savings accounts.

CIRFLW 9
Simulates the effect of a change in consumption of the "Circular flow model of goods, services and money."

CONSMP 15
A simulation of economic depression and equilibrium as effects of consumption.

STOCK 22
Simulates the stock market.

Volume VI

TEACHER ASSISTANCE

AVERG1 1
Averages grades, lists value of curve, and adjusts grades.

AVERG2 3
Sorts and averages grades.

FREQ 6
Prints a frequency distribution (bar graph) of grades.

GRADE 8
Prints a table of grades (in percentages), number of questions missed, and number of questions answered correctly.

ITEM1 10
Counts and prints number of times questions are missed.

ITEM2 12
Sums item analysis.

STAT 15
A statistical analysis of laboratory data. (For teachers' use)

STATAL 23
Calculates the arithmetic mean (average) of a set of numbers.

DISCIPLINE SOCIAL STUDIES

SUBJECT DISTINCTION BETWEEN BALANCE OF TRADE AND BALANCE OF PAYMENTS

PROGRAM NAME BALANC

DESCRIPTION:

This program demonstrates the distinction between "balance of trade" and "balance of payments." Also shown are the components that make up the "balance of payments" account, and their individual impacts.

OBJECTIVES:

A. To emphasize the important distinction between "Balance of Trade," and "Balance of Payments."

B. To demonstrate the impact of any specific foreign expenditure on our "Balance of Payments."

PRELIMINARY PREPARATION:

A. Student must obtain data for components of balance of payments for a given year and country.

B. Discussion of the concepts "balance of trade" and "balance of payments", would be helpful but are not necessary.

DISCUSSION:

A. Student level - average

B. Curriculum location - advanced economics: Unit on U. S. Economy in the world.

C. This program may be used either as a group exercise, or for individual study.

```
THERE'S A DISTINCTION BETWEEN TRADE BALANCE AND
BALANCE OF PAYMENTS.

TRADE BALANCE = EXPORTS-IMPORTS.

BALANCE OF PAYMENTS= ALL OVERSEAS EXCHANGES+
ALL OVERSEAS EXPENDITURES.

WHEN INFORMATION IS REQUESTED, INPUT VALUES IN
MILLIONS OF DOLLARS (E.G. 6 = 6 MILLION DOLLARS)

A.
INPUT A FIGURE FIRST FOR ALL MILITARY AID, THEN
FOR ALL OTHER AID TO OTHER NATIONS.
? 12,13

B.
INPUT A FIGURE FIRST FOR EXPORTS, THEN FOR IMPORTS.
? 256,23

C.
INPUT A FIGURE FIRST FOR FOREIGNERS TRAVELING IN
YOUR COUNTRY, THEN FOR YOUR COUNTRYMEN TRAVELING
ABROAD.
? 254,6-56

D.
INPUT A FIGURE FIRST FOR INCOME FROM FOREIGN INVEST-
MENTS, THEN FOR FOREIGN INVESTMENT ITSELF.
? 259,21

A. FOREIGN AID =              25

B. BALANCE OF TRADE =         233

C. TRAVEL BALANCE =           198

D. INVESTMENT BALANCE =       238

----------                    ----------

BALANCE OF PAYMENTS =         644

(REMEMBER, IF A MINUS FIGURE APPEARS ABOVE,YOUR
COUNTRY HAS A DEFICIT IN ITS BALANCE OF PAYMENTS)

HOPE YOU UNDERSTAND THE DISTINCTION BETWEEN THE
BALANCE OF TRADE AND THE BALANCE OF PAYMENTS
BETTER NOW.


READY
```


0 Copyright 1971, Polytechnic Institute of Brooklyn

```
1REMPROGRAM BY J.V.SWARTZ, HALF HOLLOW HILLS, 7/68
5PRINT"THERE'S A DISTINCTION BETWEEN TRADE BALANCE AND"
7PRINT"BALANCE OF PAYMENTS."
8PRINT
10PRINT"TRADE BALANCE = EXPORTS-IMPORTS."
15PRINT
20PRINT"BALANCE OF PAYMENTS= ALL OVERSEAS EXCHANGES+"
22PRINT"ALL OVERSEAS EXPENDITURES."
23 PRINT
25 PRINT "WHEN INFORMATION IS REQUESTED, INPUT VALUES IN"
27 PRINT "MILLIONS OF DOLLARS (E.G. 6 = 6 MILLION DOLLARS)"
30PRINT
33 PRINT "A."
35PRINT"INPUT A FIGURE FIRST FOR ALL MILITARY AID, THEN"
36PRINT"FOR ALL OTHER AID TO OTHER NATIONS."
45 INPUT F1,F2
50LETF=F1+F2
52PRINT
54 PRINT "B."
55PRINT"INPUT A FIGURE FIRST FOR EXPORTS, THEN FOR IMPORTS."
65INPUT S1,S2
70LETS=S1-S2
72PRINT
74 PRINT "C."
75PRINT"INPUT A FIGURE FIRST FOR FOREIGNERS TRAVELING IN"
76PRINT"YOUR COUNTRY, THEN FOR YOUR COUNTRYMEN TRAVELING"
77PRINT"ABROAD."
85INPUTT1,T2
90LET T=T1-T2
92PRINT
94 PRINT "D."
95PRINT"INPUT A FIGURE FIRST FOR INCOME FROM FOREIGN INVEST-"
96PRINT"MENTS, THEN FOR FOREIGN INVESTMENT ITSELF."
105INPUT I1,I2
110LET I=I1-I2
115LETP=-F+S+T+I
117PRINT
118PRINT
120 PRINT "A. FOREIGN AID =",F
125PRINT
130 PRINT "B. BALANCE OF TRADE =",S
140PRINT
145 PRINT "C. TRAVEL BALANCE =",T
150PRINT
155 PRINT "D. INVESTMENT BALANCE =",I
158PRINT
160 PRINT "----------"," ","----------"
162PRINT
170 PRINT "BALANCE OF PAYMENTS =",P
171PRINT
172PRINT"(REMEMBER, IF A MINUS FIGURE APPEARS ABOVE,YOUR"
173PRINT"COUNTRY HAS A DEFICIT IN ITS BALANCE OF PAYMENTS)"
181PRINT
185PRINT"HOPE YOU UNDERSTAND THE DISTINCTION BETWEEN THE"
186PRINT"BALANCE OF TRADE AND THE BALANCE OF PAYMENTS"
187PRINT"BETTER NOW."
190END
```

DISCIPLINE MATHEMATICS-SOCIAL SCIENCE

SUBJECT FINANCIAL PROBLEMS

PROGRAM NAME BANK

DESCRIPTION:

This program solves financial problems concerning installment buying, long-term loans, and savings accounts. The program gives you a choice of these three types of problems, and asks for the information needed to do said problems.

OBJECTIVES:

A. This program aids students in learning the terms used in certain financial problems.

B. Student will hopefully be motivated to learn the mathematical logic behind the solution of these problems.

PRELIMINARY PREPARATION:

A. Student - A review of decimals and fractions would be helpful.

B. Materials - A terminal, and a means by which to display the output to an entire class (e.g. overhead projector, closed circuit TV, etc.)

DISCUSSION:

A type of problem may be demonstrated through the use of the computer, then the mathematical logic behind the solution of the problem may be developed through the use of a flow chart similar to the one that follows.

Terminology may be taught when the computer asks for input (see sample run).

Since the execution time of one run is extremely short, many more problems may be demonstrated. Depending upon the ability of the class or student, a variety of relationships may be discovered.

© Copyright 1971, Polytechnic Institute of Brooklyn

```
                    FINANCIAL PROBLEMS

THIS PROGRAM SOLVES THREE TYPES OF PROBLEMS:

     (1) INTEREST ON INSTALLMENT BUYING
     (2) PAYMENTS ON LONG TERM LOAN
     (3) BALANCE OF A SAVINGS ACCOUNT

WHICH PROBLEM WOULD YOU LIKE TO WORK WITH (TYPE 1, 2 OR 3)? 1

*****

THIS SECTION WILL DETERMINE THE ACTUAL INTEREST YOU PAY
WHEN YOU PURCHASE SOMETHING ON CREDIT.

WHAT IS THE CASH PRICE OF THE ARTICLE ($)? 88.99
          DOWN PAYMENT ($)? 10
          NUMBER OF PAYMENTS EXCLUDING THE DOWN PAYMENT? 18
          NUMBER OF PAYMENTS PER MONTH? 1
          AMOUNT PER PAYMENT ($)? 4.85


THE RATE OF INTEREST CHARGED WAS 5.69  PERCENT.


*****

WOULD YOU LIKE TO RUN THE PROGRAM AGAIN (1-YES, 0-NO)? 1
WHICH PROBLEM WOULD YOU LIKE TO WORK WITH (TYPE 1, 2 OR 3)? 2

*****

THIS SECTION WILL DETERMINE PAYMENTS FOR A LONG TERM LOAN.

WHAT IS THE AMOUNT BORROWED ($)? 3000
          INTEREST CHARGED (%)? 8
          INTERVAL BETWEEN PAYMENTS (MONTHS)? 1
          TERM OF THE LOAN (YEARS)? 8

DO YOU WISH TO SEE THE TOTALS ONLY - INSTEAD OF THE ENTIRE
TABLE - (1-YES, 0-NO)? 0
```

PERIOD	OUTSTANDING PRINCIPAL AT BEGINNING OF PERIOD	INTEREST DUE AT END OF PERIOD	PRINCIPAL REPAID AT END OF PERIOD
1	3000	20	115.68
2	2884.32	19.23	116.45
3	2767.87	18.45	117.23
4	2650.64	17.67	118.01
5	2532.63	16.88	118.8
6	2413.83	16.09	119.59
7	2294.24	15.29	120.39
8	2173.85	14.49	121.19
9	2052.66	13.68	122
10	1930.66	12.87	122.81
11	1807.85	12.05	123.63
12	1684.22	11.23	124.45
13	1559.77	10.4	125.28
14	1434.49	9.56	126.12
15	1308.37	8.72	126.96
16	1181.41	7.88	127.8
17	1053.61	7.08	128.66
18	924.95	6.17	129.51
19	795.44	5.3	130.38
20	665.06	4.43	131.25
21	533.81	3.56	132.12
22	401.69	2.68	133
23	268.69	1.79	133.89
24	134.8	.9	134.78
TOTALS		256.34	3000

```
YOUR MONTHLY PAYMENT IS $ 135.68  AND TOTALS $ 3256.34
```

```
*****

WOULD YOU LIKE TO RUN THE PROGRAM AGAIN (1-YES, 0-NO)? 1
WHICH PROBLEM WOULD YOU LIKE TO WORK WITH (TYPE 1, 2 OR 3)? 3

*****

THIS SECTION CALCULATES THE BALANCE OF A SAVINGS ACCOUNT
IN WHICH DEPOSITS ARE MADE REGULARLY.

WHAT IS THE AMOUNT DEPOSITED PER INTEREST PERIOD ($)? 10000
HOW OFTEN IS THE INTEREST COMPOUNDED (MONTHS)? 3
WHAT IS THE RATE OF INTEREST PAID (%)? 5
FOR HOW LONG WILL YOU DEPOSIT MONEY (YEARS)? 5


THE BALANCE OF YOUR ACCOUNT AFTER  5 YEARS WILL BE $ 202500


*****

WOULD YOU LIKE TO RUN THE PROGRAM AGAIN (1-YES, 0-NO)? 0

READY
```


© Copyright 1971, Polytechnic Institute of Brooklyn

```
100 REM FINANCIAL PROBLEMS   A. WEBB  12/67
101 REM REVISED 8/25/70 (D. PESSEL)
110 PRINT TAB(20);"FINANCIAL PROBLEMS"
115 REM REVISED BY W. TEPPER,  WYANDANCH H.S.  7/10/69
120 PRINT
130 PRINT"THIS PROGRAM SOLVES THREE TYPES OF PROBLEMS:"
132 PRINT
134 PRINT"     (1) INTEREST ON INSTALLMENT BUYING"
136 PRINT"     (2) PAYMENTS ON LONG TERM LOAN"
138 PRINT"     (3) BALANCE OF A SAVINGS ACCOUNT"
140 PRINT
142 PRINT"WHICH PROBLEM WOULD YOU LIKE TO WORK WITH (TYPE 1, 2 OR 3)";
144 INPUT Q1
146 PRINT
147 PRINT"*****"
148 PRINT
150 IF Q1>2 THEN 820
155 IF Q1>1 THEN 260
160 GO TO 590
260PRINT "THIS SECTION WILL DETERMINE PAYMENTS FOR A LONG TERM LOAN."
270 PRINT
280 PRINT"WHAT IS THE AMOUNT BORROWED ($)";
281 INPUT A
285 PRINT"                INTEREST CHARGED (%)";
286 INPUT I
290 PRINT"                INTERVAL BETWEEN PAYMENTS (MONTHS)";
291 INPUT P
295 PRINT"                TERM OF THE LOAN (YEARS)";
296 INPUT Y
300 PRINT
360 PRINT"DO YOU WISH TO SEE THE TOTALS ONLY - INSTEAD OF THE ENTIRE"
361 PRINT"TABLE - (1-YES, 0-NO)";
362 INPUT P5
370 PRINT
375 IF P5>0 THEN 430
380 PRINT"              OUTSTANDING"
390 PRINT"              PRINCIPAL AT
400 PRINT"              BEGINNING          INTEREST DUE AT      PRINCIPAL"
410 PRINT"PERIOD        OF PERIOD          END OF PERIOD        REPAID AT"
420 PRINT                                                       END OF PERIOD"
430 LET Z=(Y*12)/P
440 LET K=(I*(P/12))/100
445 LET E=A*K/(1-1/(1+K)↑Z)
446 LET E=INT(E*100+.5)/100
450 LET C=A
460 LET F=0
461 LET D1=0
470 LET T1=0
480 LET T1=T1+1
490 IF T1>Z THEN 554
500 LET B=T1
510 LET C=C-F
520 LET D=C*K
522 LET F=E-D
525 LET C=INT(C*100+.5)/100
530 LET D=INT(D*100+.5)/100
535 LET F=INT(F*100+.5)/100
541 LET D1=D1+D
548 IF P5>0 THEN 480
550 PRINT B;TAB(11);C;TAB(29);D;TAB(48);F
```

```
552 GO TO 480
554 IF P5<1 THEN 561
555 PRINT
556 LET D1=INT(D1*100+.5)/100
558 PRINT"TOTAL INTEREST PAID - $"D1
559 PRINT"TOTAOL PRINCIPAL REPAID - $"A
560 GO TO 565
561 PRINT"                                   ---------------     -------------"
564 PRINT"TOTALS";TAB(29);D1;TAB(48);A
565 LET E5=INT((D1+A)*100+.5)/100
566 PRINT
567 LET E6=E5/((Y*12)/P)
568 LET E6=INT(100*E6+.5)/100
569 PRINT"YOUR MONTHLY PAYMENT IS $"E6" AND TOTALS $"E5
570 GO TO 1060
590 PRINT"THIS SECTION WILL DETERMINE THE ACTUAL INTEREST YOU PAY"
600 PRINT"WHEN YOU PURCHASE SOMETHING ON CREDIT."
610 PRINT
620 PRINT"WHAT IS THE CASH PRICE OF THE ARTICLE ($)";
621 INPUT C
630 PRINT"            DOWN PAYMENT ($)";
631 INPUT D
640 PRINT"            NUMBER OF PAYMENTS EXCLUDING THE DOWN PAYMENT";
641 INPUT N
650 PRINT"            NUMBER OF PAYMENTS PER MONTH";
651 INPUT S
660 PRINT"            AMOUNT PER PAYMENT ($)";
661 INPUT R
690 PRINT
720 LET B=R*N+D
730 LET I=B-C
740 LET M=N/(S*12)
750 LET T=I*100/(B*M)
760 PRINT
770 PRINT
775 LET T=INT(100*T+.5)/100
780PRINT "THE RATE OF INTEREST CHARGED WAS"T" PERCENT."
790 GO TO 1060
820 PRINT"THIS SECTION CALCULATES THE BALANCE OF A SAVINGS ACCOUNT"
830 PRINT"IN WHICH DEPOSITS ARE MADE REGULARLY."
840 PRINT
860 PRINT"WHAT IS THE AMOUNT DEPOSITED PER INTEREST PERIOD ($)";
861 INPUT A
870 PRINT"HOW OFTEN IS THE INTEREST COMPOUNDED (MONTHS)";
871 INPUT B
880 PRINT"WHAT IS THE RATE OF INTEREST PAID (%)";
881 INPUT C
890 PRINT"FOR HOW LONG WILL YOU DEPOSIT MONEY (YEARS)";
891 INPUT D
950 LET F=0
960 LET E=(C/100)/(12/B)
970 LET G=(12/B)*D
980 LET T1=0
990 LET T1=T1+1
1000 IF T1=G+1 THEN 1030
1010 LET F=(E*A)+(A+F)
1020 GO TO 990
1030 PRINT
1040 PRINT
1045 LET F=INT(100*F+.5)/100
1050 PRINT"THE BALANCE OF YOUR ACCOUNT AFTER "D"YEARS WILL BE $"F
1060 PRINT
1070 PRINT
1080 PRINT
1081 PRINT"*****"
1082 PRINT
1084 PRINT"WOULD YOU LIKE TO RUN THE PROGRAM AGAIN (1-YES, 0-NO)";
1086 INPUT Q4
1090 IF Q4>0 THEN 142
1100 END
```


© Copyright 1971, Polytechnic Institute of Brooklyn

DISCIPLINE SOCIAL STUDIES

SUBJECT CIRCULAR FLOW BETWEEN BUSINESS AND CONSUMER

PROGRAM NAME CIRFLW

DESCRIPTION:

Simulation of the circular flow of goods, services, and money, between business and the consumer in a free enterprise economy without government control.

OBJECTIVES:

A. To explore the effect of personal consumption upon business' demand for productive services from the individual, and upon personal income.

B. To demonstrate that widespread uninvested savings can cause a general drop in income.

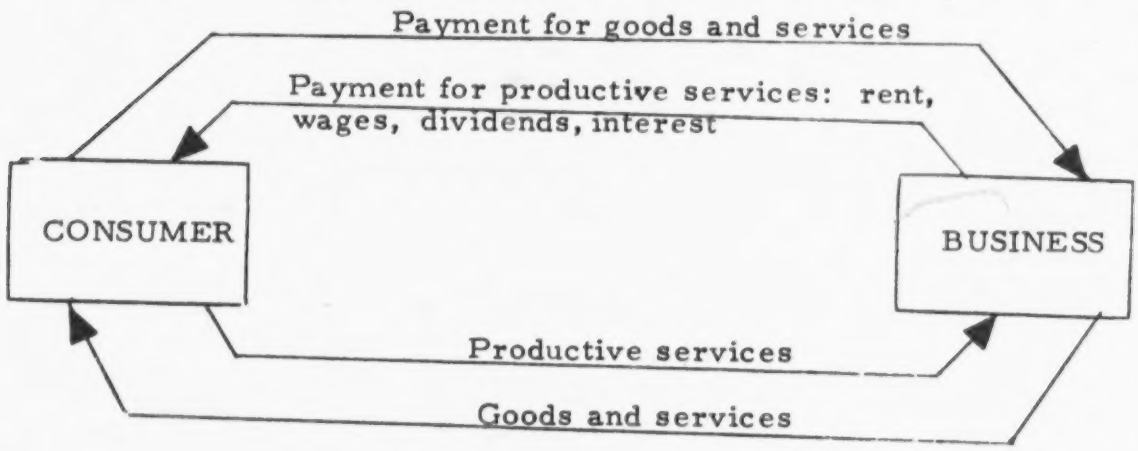
C. To demonstrate how credit buying can raise personal income, in general.

PRELIMINARY PREPARATION:

A. Student

1. Terms to define:
   a. propensity to consume
   b. savings
   c. credit
   d. circular flow of goods, services, and money

2. Concepts for explanation or discussion:



CIRCULAR FLOW

DISCUSSION:

A. Operational Suggestions

1. Student level-average to above average ability
2. Placement in curriculum- Unit: Economic growth and stability
3. Group size- may be used individually, with small groups, or as a teacher demonstration.

B. Follow-up

Suggested classroom activities:

1. Use the circular flow chart to illustrate one or more of the program "run-offs".
2. Discuss the lack of aggregate demand as a cause for recession; and the rise in aggregate demand as a cause for growth or inflation.

© Copyright 1971, Polytechnic Institute of Brooklyn

THE FOLLOWING WILL SIMULATE THE EFFECT ON THE
CIRCULAR FLOW OF GOODS, SERVICES AND MONEY WHEN
ALL THE INDIVIDUALS IN THE ECONOMY SPEND ALL THEIR
INCOME. IF THE AVERAGE INCOME IS $2,500 AND
EVERY INDIVIDUAL SPENDS 100 PERCENT OF IT,
EACH INCOME WILL BE IN EQUILIBRIUM--THEY WILL
EARN BACK FROM BUSINESS $2500
THE FOLLOWING WILL BE A COMPUTATION OF THE
VALUES IN THE CIRCULAR FLOW

AVERAGE INCOME- 2500

PROPENSITY TO CONSUME IS
100 PERCENT

INDIVIDUAL'S PAYMENTS FOR
GOODS AND SERVICES- 2500

THE VALUE OF GOODS
AND SERVICES- 2500

THE PERCENT OF PRODUCTIVE
SERVICES BUSINESS WANTS
IS 100 PERCENT.

THE RETURN INCOME
TO INDIVIDUAL-2500.

THE ABOVE REPRESENTS THE AVERAGE OF ALL INDIVIDUAL
INCOMES IN THE ECONOMY. SINCE ALL INDIVIDUALS CONSUMED
100 PERCENT OF THEIR INCOME,THEIR RETURN INCOMEIS
100 PERCENT OF THEIR PREVIOUS INCOME. THIS HAPPENS
BECAUSE BUSINESS NEEDS 100 PERCENT OF THE PREVIOUS
PRODUCTIVE SERVICES TO MEET THE DEMAND.

THE RETURN INCOME TO THE INDIVIDUAL FROM
BUSINESS DEPENDS TO A LARGE EXTENT ON HOW
MUCH ALL INDIVIDUALS SPEND(THEIR PROPENSITY TO
CONSUME). COMMON SENSE TELLS US THAT IF AN IN-
DIVIDUAL SAVES PART OF HIS INCOME AND INVESTS IT
IN A BANK, HE WILL RAISE HIS INCOME BY MEANS OF
THE INTEREST ON HIS SAVINGS. BUT IF ALL OR MANY
OF THE INDIVIDUAL CONSUMERS IN THE ECONOMY CUT
THEIR CONSUMPTION, THEN THE OVERALL RETURN INCOME
TO THOSE INDIVIDUALS WILL PROBABLY DROP.
BY CHANGING THE PERCENTAGE OF YOUR PROPENSITY
TO CONSUME YOU CAN CHANGE YOUR INCOME.

A PROPENSITY TO CONSUME OF 100 PERCENT WILL,
IN THIS SIMULATION, GIVE YOU A RETURN INCOME
EQUAL TO YOUR ORIGINAL INCOME. ANY VALUE
MORE OR LESS THAN 100 PERCENT WILL CHANGE
YOUR RETURN INCOME.

TYPE IN A VALUE FOR THE PROPENSITY TO CONSUME,
A PERCENTAGE MORE OR LESS THAN 100 PERCENT.
PUT IT IN IN DECIMAL FORM (E.G. .75=75 PERCENT)

```
WHAT IS THE VALUE? .75
BECAUSE YOUR PROPENSITY TO CONSUME IS LESS THAN
YOUR INCOME, YOU ARE SAVING MONEY.  WE WILL ASSUME
THAT YOU DIDN'T PUT IT IN A BANK BUT
RATHER STUFFED IT UNDER YOUR MATTRESS, SO
YOU WON'T RAISE YOUR INCOME WITH INTEREST

INDIVIDUAL'S PAYMENTS FOR
GOODS AND SERVICES- 1875

VALUE OF GOODS AND SERVICES
FROM BUSINESS- 1875

PERCENT OF PRODUCTIVE
SERVICES IN DEMAND- .75

RETURN INCOME TO IN-
DIVIDUAL- 1875

YOUR RETURN INCOME
HAS DROPPED THE FOLLOWING
PERCENTAGE POINTS FROM
100 PERCENT- 25
IF YOU WISH TO PUT IN ANOTHER PERCENTAGE VALUE
FOR THE PROPENSITY TO CONSUME, TYPE 0
IF YOU WISH TO STOP THE PROGRAM, TYPE 1
? 1

READY
```


© Copyright 1971, Polytechnic Institute of Brooklyn

```
100REM THIS PROGRAM BY JAMESEDER, NORTHPORT HS, 8/68
105 REM  REVISED BY C.LOSIK  8-27-70
110REM IT'S DESIGNED TO DEMONSTRATE THE CIRCULAR FLOW OF
120REM GOODS AND SERVICES IN THE U.S. ECONOMY.
130REM THE FOLLOWING ARE DEFINITIONS OF THE SYMBOLS USED:
140REM PER CAPITA INCOME IS I,IO;PROPENSITY TO CONSUME IS C,CO;
150REM PAYMENT FOR GOODS + SERVICES IS P,PO;VALUE OF GOODS IS
160REM V,VO;PERCENT OF PRODUCTIVE SERVICES IS S,SO;
170REM RETURN INCOME IS R,RO
180PRINT"THE FOLLOWING WILL SIMULATE THE EFFECT ON THE"
190PRINT"CIRCULAR FLOW OF GOODS, SERVICES AND MONEY WHEN"
200PRINT"ALL THE INDIVIDUALS IN THE ECONOMY SPEND ALL THEIR"
210PRINT"INCOME.  IF THE AVERAGE INCOME IS $2,500 AND"
220PRINT"EVERY INDIVIDUAL SPENDS 100 PERCENT OF IT,"
230PRINT"EACH INCOME WILL BE IN EQUILIBRIUM--THEY WILL"
240PRINT"EARN BACK FROM BUSINESS $2500"
250PRINT"THE FOLLOWING WILL BE A COMPUTATION OF THE"
260PRINT"VALUES IN THE CIRCULAR FLOW"
270READI,C,IO
280DATA 2500,1,2500
290PRINT
300PRINT"AVERAGE INCOME-";I
310PRINT
320PRINT
330PRINT"PROPENSITY TO CONSUME IS"
340PRINT"100 PERCENT"
350LET P=C*I
360PRINT
370PRINT"INDIVIDUAL'S PAYMENTS FOR"
380PRINT"GOODS AND SERVICES-";P
390LETV=P
400PRINT
410PRINT"THE VALUE OF GOODS"
420PRINT"AND SERVICES-";V
430PRINT
440PRINT
450PRINT"THE PERCENT OF PRODUCTIVE"
460PRINT"SERVICES BUSINESS WANTS"
470PRINT"IS 100 PERCENT."
480PRINT
490PRINT
500PRINT"THE RETURN INCOME"
510PRINT"TO INDIVIDUAL-2500."
520PRINT
530PRINT"THE ABOVE REPRESENTS THE AVERAGE OF ALL INDIVIDUAL"
540PRINT"INCOMES IN THE ECONOMY.  SINCE ALL INDIVIDUALS CONSUMED"
550PRINT"100 PERCENT OF THEIR INCOME,THEIR RETURN INCOMEIS"
560PRINT"100 PERCENT OF THEIR PREVIOUS INCOME. THIS HAPPENS"
570PRINT"BECAUSE BUSINESS NEEDS 100 PERCENT OF THE PREVIOUS"
580PRINT"PRODUCTIVE SERVICES TO MEET THE DEMAND."
590PRINT
600PRINT"THE RETURN INCOME TO THE INDIVIDUAL FROM"
610PRINT"BUSINESS DEPENDS TO A LARGE EXTENT ON HOW"
620PRINT"MUCH ALL INDIVIDUALS SPEND(THEIR PROPENSITY TO"
630PRINT"CONSUME).  COMMON SENSE TELLS US THAT IF AN IN-"
640PRINT"DIVIDUAL SAVES PART OF HIS INCOME AND INVESTS IT"
650PRINT"IN A BANK, HE WILL RAISE HIS INCOME BY MEANS OF"
660PRINT"THE INTEREST ON HIS SAVINGS.  BUT IF ALL OR MANY"
670PRINT"OF THE INDIVIDUAL CONSUMERS IN THE ECONOMY CUT"
680PRINT"THEIR CONSUMPTION, THEN THE OVERALL RETURN INCOME"
690PRINT"TO THOSE INDIVIDUALS WILL PROBABLY DROP."
700PRINT"BY CHANGING THE PERCENTAGE OF YOUR PROPENSITY "
710PRINT"TO CONSUME YOU CAN CHANGE YOUR INCOME."
720PRINT
730PRINT"A PROPENSITY TO CONSUME OF 100 PERCENT WILL,"
740PRINT"IN THIS SIMULATION, GIVE YOU A RETURN INCOME"
```

```
750PRINT"EQUAL TO YOUR ORIGINAL INCOME.  ANY VALUE"
760PRINT"MORE OR LESS THAN 100 PERCENT WILL CHANGE"
770PRINT"YOUR RETURN INCOME."
780PRINT
790LETN=1
800 PRINT "TYPE IN A VALUE FOR THE PROPENSITY TO CONSUME,"
810 PRINT "A PERCENTAGE MORE OR LESS THAN 100 PERCENT."
820 PRINT "PUT IT IN IN DECIMAL FORM (E.G. .75=75 PERCENT)"
830 PRINT
840 PRINT "WHAT IS THE VALUE";
850INPUTC0
860IFC0<1 THEN 960
870IFC0>1THEN 1030
890IFN=3 THEN930
900PRINT"WE'LL GO BACK"
910LETN=N+1
920GOTO 800
930PRINT"EITHER YOU WERE CARELESS OR YOU WERE BEING "
940PRINT"WISE. IN EITHER CASE, SUFFER THE CONSEQUENCES."
950 STOP
960PRINT"BECAUSE YOUR PROPENSITY TO CONSUME IS LESS THAN"
970PRINT"YOUR INCOME, YOU ARE SAVING MONEY.  WE WILL ASSUME"
980PRINT"THAT YOU DIDN'T PUT IT IN A BANK BUT"
990PRINT"RATHER STUFFED IT UNDER YOUR MATTRESS, SO"
1000PRINT"YOU WON'T RAISE YOUR INCOME WITH INTEREST"
1010GOTO1070
1020PRINT
1030PRINT"BECAUSE YOUR PROPENSITY TO CONSUME IS GREATER"
1040PRINT"THAN YOUR INCOME, YOU ARE BUYING ON CREDIT."
1050PRINT"THAT MEANS YOU ARE BUYING NOW WITH WHAT YOU EXPECT "
1060PRINT"TO EARN IN THE FUTURE."
1070LETP0=I0*C0
1080PRINT
1090PRINT"INDIVIDUAL'S PAYMENTS FOR"
1100PRINT"GOODS AND SERVICES-";P0
1110PRINT
1120LET V0=P0
1130PRINT"VALUE OF GOODS AND SERVICES"
1140PRINT"FROM BUSINESS-";V0
1150LETS0=C0
1160PRINT
1170PRINT"PERCENT OF PRODUCTIVE"
1180PRINT"SERVICES IN DEMAND-";S0
1190LET R0=I0*S0
1200PRINT
1210PRINT"RETURN INCOME TO IN-"
1220PRINT"DIVIDUAL-";R0
1230PRINT
1240IFR0<2500 THEN 1270
1250IFR0>=2500THEN 1320
1260PRINT
1270 LET P2=INT(100-100*C0+.5)
1280PRINT"YOUR RETURN INCOME"
1290PRINT"HAS DROPPED THE FOLLOWING"
1300PRINT"PERCENTAGE POINTS FROM"
1310PRINT"100 PERCENT-";P2
1320PRINT"IF YOU WISH TO PUT IN ANOTHER PERCENTAGE VALUE"
1330PRINT"FOR THE PROPENSITY TO CONSUME, TYPE 0"
1340PRINT"IF YOU WISH TO STOP THE PROGRAM, TYPE 1"
1350INPUT W
1355 PRINT
1360IF W=0 THEN 800
1365 IF W<>1 THEN 1320
1370END
```


© Copyright 1971, Polytechnic Institute of Brooklyn

DISCIPLINE SOCIAL STUDIES

SUBJECT DEPRESSION/EQUILIBRIUM

PROGRAM NAME CONSMP

DESCRIPTION:

This program simulates economic depression and equilibrium as effects of consumption.

OBJECTIVES:

A. Depression or recession results when consumption drops below the capacity to produce.

B. Equilibrium results when consumption equals the capacity to produce.

C. One cause for "over-production" is a time-lag in discovering a drop in consumption.

PRELIMINARY PREPARATION:

A. Student - terms to define and explain:

1. Depression
2. Recession
3. Equilibrium
4. Under-consumption
5. Overproduction
6. Investment
7. Savings
8. GNP
9. Productive Services

B. Materials - Introduce this program with the Circular Flow model of goods, services and money. (See program CIRFLW)

DISCUSSION:

A. Operational Suggestions

1. Student level - above average
2. Curriculum location - advanced economics unit on economic growth and stability.

B. Suggested Follow-up

Discussion topics:

1. Consider possible causes for a drop in consumption.
2. With advanced students, discuss the (Keynesian) concept of "equilibrium at less than full employment."

```
THIS PROGRAM SIMULATES THE EFFECTS OF CONSUMPTION ON THE
GNP. IT PRINTS OUT THE VALUES FOR THE COMPONENTS OF THE
CIRCULAR FLOW MODEL OF GOODS, SERVICES AND MONEY.

ASSUME GNP IS 100 BILLION.
TYPE IN A VALUE FOR PROPENSITY TO CONSUME.
MAKE THE VALUE BETWEEN 0 AND .75
? .75

ORIGINAL GNP- 100

PROPENSITY TO
CONSUME- .75

CONSUMPTION- 75

VALUE OF GOODS
+ SERVICES- 75

SAVINGS- 25

INVEST.- 25

LABOR- .75

RETURN GNP- 100

EQUILIBRIUM.


TO PUT IN ANOTHER CONSUMPTION VALUE,TYPE 0.
TO STOP, TYPE 1
? 0
TYPE IN A VALUE FOR PROPENSITY TO CONSUME.
MAKE THE VALUE BETWEEN 0 AND .75
? .80
READ CAREFULLY;INPUT AGAIN.
? 7-.70
IF STARTING ,TYPE 100(GNP);IF NOT
STARTING,TYPE VALUE OF RETURN GNP.
? 100

ORIGINAL GNP- 100

PROPENSITY TO
CONSUME- .7

CONSUMPTION- 70

VALUE- 70

SAVINGS- 30

INVESTMENT BY PERIODS:
1-3MONTHS 5
4-6MONTHS 4.9375
7-9MONTHS 4.875
10-12MONTHS 4.8125
END OF 12TH MONTH 4.75
TOTAL FOR YEAR 24.375
```

```
OVER-INVESTMENT

LABOR:
1-3MONTHS- .15
4-6MONTHS- .1475
7-9MONTHS- .145
10-12MONTHS- .1425
END OF 12MONTH- .14
TOTAL FOR YEAR- .725

GNP:
1-3MONTHS- 15
4-6MONTHS- 14.9875
7-9MONTHS- 14.975
10-12MONTHS- 14.9625
END OF 12 MONTH- 14.95
TOTAL FOR YEAR- 94.375

RECESSION
INVENTORY OVERPRODUCED- 23.125
TYPE DECIMAL VALUE FOR PROPENSITY TO
CONSUME
? .65
IF STARTING ,TYPE 100(GNP);IF NOT
STARTING,TYPE VALUE OF RETURN GNP.
? 94.375

ORIGINAL GNP- 100

PROPENSITY TO
CONSUME- .65

CONSUMPTION- 61.34375

VALUE- 61.34375

SAVINGS- 33.03125

GNP- 63.21875
TYPE DECIMAL VALUE FOR PROPENSITY TO
CONSUME
? .60
IF STARTING ,TYPE 100(GNP);IF NOT
STARTING,TYPE VALUE OF RETURN GNP.
? 63.21875

ORIGINAL GNP- 100

PROPENSITY TO
CONSUME- .6

CONSUMPTION- 37.93125

VALUE- 37.93125

SAVINGS- 25.2875

GNP- 41.68125
TYPE DECIMAL VALUE FOR PROPENSITY TO
CONSUME
? .55
IF STARTING ,TYPE 100(GNP);IF NOT
STARTING,TYPE VALUE OF RETURN GNP.
? 41.68125
```

```
ORIGINAL GNP- 100

PROPENSITY TO
CONSUME- .55

CONSUMPTION- 22.92469

VALUE- 22.92469

SAVINGS- 18.75656

GNP- 28.54969
TYPE DECIMAL VALUE FOR PROPENSITY TO
CONSUME
?
↑C

READY
```


© Copyright 1971, Polytechnic Institute of Brooklyn

```
100REM--PROGRAM BY JAMES EDER, NORTHPORT HS, 8/68
110REM--REVISED--8/12/69--<ROD>
115 REM  REVISED BY C.LOSIK  8-27-70
120PRINT"THIS PROGRAM SIMULATES THE EFFECTS OF CONSUMPTION ON THE"
130PRINT"GNP. IT PRINTS OUT THE VALUES FOR THE COMPONENTS OF THE"
140PRINT"CIRCULAR FLOW MODEL OF GOODS, SERVICES AND MONEY."
170PRINT
180READY,P1
190DATA100,.75
200PRINT"ASSUME GNP IS 100 BILLION."
210 PRINT "TYPE IN A VALUE FOR PROPENSITY TO CONSUME."
220 PRINT "MAKE THE VALUE BETWEEN 0 AND .75"
230LETC1=Y*P1
240LETI1=Y-C1
250 LET N=0
260INPUT P2
265 LET N=N+1
266 IF P2<0 THEN 220
270IFP2=.75THEN420
280IFP2<.75THEN770
310IFN=2THEN360
320IFN=3THEN390
330PRINT"READ CAREFULLY;INPUT AGAIN."
350GOTO260
360PRINT"COME ON...I'M WARNING YOU."
380GOTO260
390PRINT"OK WISE GUY,YOU'RE OFF."
400GOTO1930
410PRINT
420LETV1=C1
430LETS1=Y-C1
440LETL1=P1
450LETY1=C1+I1
460PRINT
470PRINT"ORIGINAL GNP-";Y
480PRINT
490PRINT"PROPENSITY TO"
500PRINT"CONSUME-";P2
510PRINT
520PRINT"CONSUMPTION-";C1
530PRINT
540PRINT"VALUE OF GOODS"
550PRINT"+ SERVICES-";V1
560PRINT
570PRINT"SAVINGS-";S1
580PRINT
590PRINT"INVEST.-";I1
600PRINT
610PRINT"LABOR-";L1
620PRINT
630PRINT"RETURN GNP-";Y1
640PRINT
650PRINT"EQUILIBRIUM."
660PRINT
670PRINT
680PRINT
690PRINT"TO PUT IN ANOTHER CONSUMPTION VALUE,TYPE 0."
700PRINT"TO STOP, TYPE 1"
710INPUTQ8
720IFQ8=0THEN210
730IFQ8=1THEN1930
740PRINT"TYPE DECIMAL VALUE FOR PROPENSITY TO"
```

```
750PRINT"CONSUME"
760GOTO260
770PRINT"IF STARTING ,TYPE 100(GNP);IF NOT"
780PRINT"STARTING,TYPE VALUE OF RETURN GNP."
790INPUTY8
800LETC2=P2*Y8
810LETV2=C2
820LETS2=Y8-C2
830PRINT
840PRINT"ORIGINAL GNP-";Y
850PRINT
860PRINT"PROPENSITY TO "
870PRINT"CONSUME-";P2
880PRINT
890PRINT"CONSUMPTION-";C2
900PRINT
910PRINT"VALUE-";V2
920PRINT
930PRINT"SAVINGS-";S2
940PRINT
950LETQ=(I1)*(P1-P2)
960LETI2=I1
970LETZ2=I2*.20
980LETI3=I1-(.25*Q)
990LETZ3=I3*.20
1000LETI4=I1-(.50*Q)
1010LETZ4=I4*.20
1020LETI5=I1-(.75*Q)
1030LETZ5=I5*.20
1040LETI6=I1-Q
1050LETZ6=I6*.20
1060LETI7=Z2+Z3+Z4+Z5+Z6
1070LETF=(C2+I2)-O
1080LETO=I7-Q
1090LETF1=F-01
1100LETO1=F-Q
1110LETF2=F1-02
1120LETO2=F1-Q
1130LETF3=F2-03
1140LETO3=F2-Q
1150LETF4=F3-04
1160LETO4=F3-Q
1170LETF5=F4-05
1180LETO5=F4-Q
1190LETF6=F5-06
1200LETO6=F5-Q
1210IFF<Y7THEN1760
1220IFF1<FTHEN1780
1230IFF2<F1THEN1800
1240IFF3<F2THEN1820
1250IFF4<F3THEN1840
1260IFF5<F4THEN1860
1270IFF6<F5THEN1880
1280PRINT"INVESTMENT BY PERIODS:"
1290PRINT"1-3MONTHS";Z2
1300PRINT"4-6MONTHS";Z3
1310PRINT"7-9MONTHS";Z4
1320PRINT"10-12MONTHS";Z5
1330PRINT"END OF 12TH MONTH";Z6
1340PRINT"TOTAL FOR YEAR";I7
1350PRINT
1360PRINT"OVER-INVESTMENT"
```


© Copyright 1971, Polytechnic Institute of Brooklyn

```
1370PRINT
1380LETQ2=P1-P2
1390LETL2=P1
1400LETX2=L2*.20
1410LETL3=P2+(.75*Q2)
1420LETX3=L3*.20
1430LETL4=P2+(.50*Q2)
1440LETX4=L4*.20
1450LETL5=P2+(.25*Q2)
1460LETX5=L5*.20
1470LETL6=P2
1480LETX6=P2*.20
1490LETL7=X2+X3+X4+X5+X6
1500PRINT"LABOR:"
1510PRINT"1-3MONTHS-";X2
1520PRINT"4-6MONTHS-";X3
1530PRINT"7-9MONTHS-";X4
1540PRINT"10-12MONTHS-";X5
1550PRINT"END OF 12MONTH-";X6
1560PRINT"TOTAL FOR YEAR-";L7
1570PRINT
1580LETY2=(C2+Z2)*.20
1590LETY3=(C2+Z3)*.20
1600LETY4=(C2+Z4)*.20
1610LETY5=(C2+Z5)*.20
1620LETY6=(C2+Z6)*.20
1630LETY7=C2+I7
1640PRINT"GNP:"
1650PRINT"1-3MONTHS-";Y2
1660PRINT"4-6MONTHS-";Y3
1670PRINT"7-9MONTHS-";Y4
1680PRINT"10-12MONTHS-";Y5
1690PRINT"END OF 12 MONTH-";Y6
1700PRINT"TOTAL FOR YEAR-";Y7
1710PRINT
1720PRINT"RECESSION"
1730LETO=I7-Q
1740PRINT"INVENTORY OVERPRODUCED-";O
1750GOTO740
1760PRINT"GNP-";F
1770IFF>0THEN740
1780PRINT"GNP--";F1
1790IFF1>0THEN740
1800PRINT"GNP--";F2
1810IFF2>0THEN740
1820PRINT"GNP--";F3
1830IFF3>0THEN740
1840PRINT"GNP--";F4
1850IFF4>0THEN740
1860PRINT"GNP--";F5
1870IFF5>0THEN740
1880PRINT"GNP--";F6
1890PRINT
1900PRINT"TOTAL DEPRESSION"
1910GOTO690
1920PRINT
1930END
```

DISCIPLINE MATHEMATICS, SOCIAL STUDIES

SUBJECT THE STOCK MARKET

PROGRAM NAME STOCK

DESCRIPTION:

This program simulates the stock market. Each student is given $10,000 with which he may buy and/or sell shares in five fictitious issues.

OBJECTIVES:

A. To give the student a simple understanding of the operations of the stock market.

B. To motivate the student to reinforce his basic arithmetic skills.

C. To give an example of the use of everyday mathematics and economics in everyday life.

PRELIMINARY PREPARATION:

A. Student - no special preparation

B. Materials - possibly graph paper

DISCUSSION:

This program can be used as a good motivation device in the teaching of basic stock-market concepts, and the basic mathematical skills involved. The computer starts each student with $10,000, and allows him to buy and/or sell shares. Precautionary tests are included for the student who tries to purchase more shares than he has money for, or to sell more shares than he actually owns. The program continues for as many trading days as the student desires.

The stock values rise and fall on a semi-random basis. On each trading day all stocks undergo a small random price change, a trend change (based on a random trend), and the possibility--on a random basis--of a large price change. The structure of the formula is:

new price=old price + (trend x old price) + (small random price change) + (possible large price change)

© Copyright 1971, Polytechnic Institute of Brooklyn

The trend is a random number between -.1 and +.1. It remains constant for a random number of days, at which time the trend is changed randomly. The trend affects all stocks equally, and attempts to simulate general market trends. The small random change ranges between -3 and +3 points. It occurs every day to every stock. The possible large price change is either +10 or -10 points. The + and - changes each occur at random day intervals, and to random stocks. That is, there may be no large change on some trading days, only a +10 change on others, a -10 change on still others, and both large and small changes on others. In all large-change cases, the change affects only one random stock when it occurs.

Because of the random generation of stock values and their fluctuations, the program does not exactly simulate the real market. It does, however, provide a simplified view of what does happen, and familiarizes the student with the basic functions involved. This should be explained to the students, along with some real causes of stock-market fluctuations.

Graph paper might be used to plot the daily stock values and the exchange average. In this way, the trend will become evident.

```
                    THE STOCK MARKET
DO YOU WANT THE INSTRUCTIONS (YES-TYPE 1, NO-TYPE 0)? 1


THIS PROGRAM PLAYS THE STOCK MARKET.  YOU WILL BE GIVEN
$10,000 AND MAY BUY OR SELL STOCKS.  THE STOCK PRICES WILL
BE GENERATED RANDOMLY AND THEREFORE THIS MODEL DOES NOT
REPRESENT EXACTLY WHAT HAPPENS ON THE EXCHANGE.  A TABLE
OF AVAILABLE STOCKS, THEIR PRICES, AND THE NUMBER OF SHARES
IN YOUR PORTFOLIO WILL BE PRINTED.  FOLLOWING THIS, THE
INITIALS OF EACH STOCK WILL BE PRINTED WITH A QUESTION
MARK.  HERE YOU INDICATE A TRANSACTION.  TO BUY A STOCK
TYPE +NNN, TO SELL A STOCK TYPE -NNN, WHERE NNN IS THE
NUMBER OF SHARES.  A BROKERAGE FEE OF 1% WILL BE CHARGED
ON ALL TRANSACTIONS.  NOTE THAT IF A STOCK'S VALUE DROPS
TO ZERO IT MAY REBOUND TO A POSITIVE VALUE AGAIN.  YOU
HAVE $10,000 TO INVEST.  USE INTEGERS FOR ALL YOUR INPUTS.
(NOTE:  TO GET A 'FEEL' FOR THE MARKET RUN FOR AT LEAST
10 DAYS)
-----GOOD LUCK!-----

STOCK                          INITIALS      PRICE/SHARE
INT. BALLISTIC MISSILES          IBM           85.75
RED CROSS OF AMERICA             RCA           85.5
LICHTENSTEIN, BUMRAP & JOKE      LBJ           155.25
AMERICAN BANKRUPT CO.            ABC           138
CENSURED BOOKS STORE             CBS           104.85

NEW YORK STOCK EXCHANGE AVERAGE:  113.75

TOTAL STOCK ASSETS ARE    $ 0
TOTAL CASH ASSETS ARE     $ 10000
TOTAL ASSETS ARE          $ 10000

WHAT IS YOUR TRANSACTION IN
IBM? 8
RCA? 3
LBJ? 1
ABC? 1
CBS? 1


**********  END OF DAY'S TRADING

STOCK        PRICE/SHARE   HOLDINGS      VALUE        NET PRICE CHANGE
IBM            98.5          8            193           10.75
RCA            81            3            243           -4.5
LBJ            153.5         1            153.5         -1.75
ABC            135.5         1            135.5         -2.5
CBS            99            1            99            -5.85


NEW YORK STOCK EXCHANGE AVERAGE:  113.1    NET CHANGE:  -.65

TOTAL STOCK ASSETS ARE    $ 824
TOTAL CASH ASSETS ARE     $ 9166.25
TOTAL ASSETS ARE          $ 9990.25

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)? 1
WHAT IS YOUR TRANSACTION IN
IBM? 5
RCA? 1
LBJ? 1
ABC? 1
CBS? 0
```


© Copyright 1971, Polytechnic Institute of Brooklyn

********** END OF DAY'S TRADING

STOCK	PRICE/SHARE	HOLDINGS	VALUE	NET PRICE CHANGE
IBM	98.75	7	691.25	8.25
RCA	82.5	4	330	1.5
LBJ	154	2	308	.5
ABC	133.5	8	867	-8
CBS	108.75	1	108.75	3.75

NEW YORK STOCK EXCHANGE AVERAGE: 114.3 NET CHANGE: 1.8

TOTAL STOCK ASSETS ARE $ 1699
TOTAL CASH ASSETS ARE $ 8305.23
TOTAL ASSETS ARE $ 10004.23

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)? 1
WHAT IS YOUR TRANSACTION IN
IBM? 3
RCA? 2
LBJ? 5
ABC? -1
CBS? 3

********** END OF DAY'S TRADING

STOCK	PRICE/SHARE	HOLDINGS	VALUE	NET PRICE CHANGE
IBM	99.25	10	992.5	.5
RCA	82.25	6	493.5	-.25
LBJ	154.75	7	1083.25	.75
ABC	133.5	1	133.5	0
CBS	103.25	4	413	.5

NEW YORK STOCK EXCHANGE AVERAGE: 114.6 NET CHANGE: .3

TOTAL STOCK ASSETS ARE $ 3115.75
TOTAL CASH ASSETS ARE $ 6882.5
TOTAL ASSETS ARE $ 9998.25

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)? 1
WHAT IS YOUR TRANSACTION IN
IBM? 5

RCA? 3
LBJ? 5
ABC? 3
CBS? 4

********** END OF DAY'S TRADING

STOCK	PRICE/SHARE	HOLDINGS	VALUE	NET PRICE CHANGE
IBM	96.75	15	1451.25	-8.5
RCA	80.5	9	724.5	-1.75
LBJ	150	12	1800	-4.75
ABC	132	4	528	-1.5
CBS	98.75	8	790	-4.5

NEW YORK STOCK EXCHANGE AVERAGE: 111.6 NET CHANGE: -3

TOTAL STOCK ASSETS ARE $ 5893.75
TOTAL CASH ASSETS ARE $ 4528.95
TOTAL ASSETS ARE $ 9828.7

```
DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)? 1
WHAT IS YOUR TRANSACTION IN
IBM? 0
RCA? -5
LBJ? -7
ABC? 0
CBS? -5


**********  END OF DAY'S TRADING

STOCK          PRICE/SHARE    HOLDINGS       VALUE          NET PRICE CHANGE
IBM              98.75          15           1451.25          0
RCA              66.75           4            267            -13.75
LBJ             150.75           5            753.75           .75
ABC              132             4            528              0
CBS              95.75           3            287.25          -3


NEW YORK STOCK EXCHANGE AVERAGE:  108.4    NET CHANGE: -3.2

TOTAL STOCK ASSETS ARE    $ 3287.25
TOTAL CASH ASSETS ARE     $ 6455.74
TOTAL ASSETS ARE          $ 9742.99

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)? 1
WHAT IS YOUR TRANSACTION IN
IBM? -10
RCA? -2
LBJ? 2
ABC? 2
CBS? 0


**********  END OF DAY'S TRADING

STOCK          PRICE/SHARE    HOLDINGS       VALUE          NET PRICE CHANGE
IBM              87.5            5            437.5          -9.25
RCA              58              2            116            -8.75
LBJ             135.25           7            946.75         -15.5
ABC              122.5           6            735            -9.5
CBS              98.75           3            296.25          3


NEW YORK STOCK EXCHANGE AVERAGE:  100.4    NET CHANGE: -8

TOTAL STOCK ASSETS ARE    $ 2531.5
TOTAL CASH ASSETS ARE     $ 6974.58
TOTAL ASSETS ARE          $ 9506.08

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)? 1
WHAT IS YOUR TRANSACTION IN
IBM? -4
RCA? -1
LBJ? -6
ABC? -8
CBS? -2
```


© Copyright 1971, Polytechnic Institute of Brooklyn

```
**********  END OF DAY'S TRADING

STOCK          PRICE/SHARE    HOLDINGS       VALUE          NET PRICE CHANGE
IBM             80             1              80            -7.5
RCA             51             1              51            -7
LBJ             181.75         1              181.75        -13.5
ABC             109.5          4              438           -13
CBS             91.5           1              91.5          -7.25


NEW YORK STOCK EXCHANGE AVERAGE:  90.75    NET CHANGE: -9.65

TOTAL STOCK ASSETS ARE    $ 782.25
TOTAL CASH ASSETS ARE     $ 8619.96
TOTAL ASSETS ARE          $ 9402.21

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)? 1
WHAT IS YOUR TRANSACTION IN
IBM? 0
RCA? 0
LBJ? 0
ABC? -3
CBS? 0


**********  END OF DAY'S TRADING

STOCK          PRICE/SHARE    HOLDINGS       VALUE          NET PRICE CHANGE
IBM             77.5           1              77.5          -8.5
RCA             52.25          1              52.25          1.25
LBJ             119.25         1              119.25        -2.5
ABC             107            1              107           -2.5
CBS             92.25          1              92.25          .75


NEW YORK STOCK EXCHANGE AVERAGE:  89.65    NET CHANGE: -1.1

TOTAL STOCK ASSETS ARE    $ 448.25
TOTAL CASH ASSETS ARE     $ 8945.18
TOTAL ASSETS ARE          $ 9393.43

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)? 1
WHAT IS YOUR TRANSACTION IN
IBM? 0
RCA? 0
LBJ? 0
ABC? 0
CBS? 10


**********  END OF DAY'S TRADING

STOCK          PRICE/SHARE    HOLDINGS       VALUE          NET PRICE CHANGE
IBM             74.5           1              74.5          -3
RCA             54             1              54             1.75
LBJ             107            1              107           -18.25
ABC             108            1              108            1
CBS             90.75          11             998.25        -1.5
```

```
NEW YORK STOCK EXCHANGE AVERAGE:  86.85    NET CHANGE: -2.8

TOTAL STOCK ASSETS ARE    $ 1341.75
TOTAL CASH ASSETS ARE     $ 8013.46
TOTAL ASSETS ARE          $ 9355.21

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)? 1
WHAT IS YOUR TRANSACTION IN
IBM? 5
RCA? 6
LBJ? 10
ABC? 10
CBS? 10


**********  END OF DAY'S TRADING

STOCK          PRICE/SHARE    HOLDINGS       VALUE          NET PRICE CHANGE
IBM              78             6             432            -2.5
RCA              58.5           7             367.5          -1.5
LBJ              105            11            1155           -2
ABC              103.25         11            1135.75        -4.75
CBS              91.5           81            1981.5          .75


NEW YORK STOCK EXCHANGE AVERAGE:  84.85    NET CHANGE: -2

TOTAL STOCK ASSETS ARE    $ 5011.75
TOTAL CASH ASSETS ARE     $ 4221.92
TOTAL ASSETS ARE          $ 9833.67

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)? 0
HOPE YOU HAD FUN!!

READY
```


© Copyright 1971, Polytechnic Institute of Brooklyn

```
100 REM STOCK MARKET SIMULATION      -STOCK-
101 REM REVISED 8/18/70 (D. PESSEL, L. BRAUN, C. LOSIK)
102 REM IMP VRBLS: A-MRKT TRND SLP; B5-BRKRGE FEE; C-TTL CSH ASSTS;
103 REM C5-TTL CSH ASSTS (TEMP); C(I)-CHNG IN STK VAL; D-TTL ASSTS;
104 REM E1,E2-LRG CHNG MISC; I-STCK #; I1,I2-STCKS W LRG CHNG;
105 REM N1,N2-LRG CHNG DAY CNTS; P5-TTL DAYS PRCHSS; P(I)-PRTFL CNTNTS;
106 REM Q9-NEW CYCL?; S4-SGN OF A; S5-TTL DYS SLS; S(I)-VALUE/SHR;
107 REM T-TTL STCK ASSTS; T5-TTL VAL OF TRNSCTNS;
108 REM W3-LRG CHNG; X1-SMLL CHNG(<$1); Z4,Z5,Z6-NYSE AVE.; Z(I)-TRNSCTN
109  PRINT TAB(20);"THE STOCK MARKET"
110  DIM S(5),P(5),Z(5),C(5)
112 REM SLOPE OF MARKET TREND:A  (SAME FOR ALL STOCKS)
113  RANDOMIZE
114  LET A=INT((RND(X)/10)*100+.5)/100
115  LET T5=0
116  LET X9=0
117  LET N1=0
118  LET N2=0
119  LET E1=0
120  LET E2=0
121 REM INTRODUCTION
122  PRINT "DO YOU WANT THE INSTRUCTIONS (YES-TYPE 1, NO-TYPE 0)";
123  INPUT Z9
124  PRINT
125  PRINT
126  IF Z9<1 THEN 200
130  PRINT "THIS PROGRAM PLAYS THE STOCK MARKET.  YOU WILL BE GIVEN"
132  PRINT "$10,000 AND MAY BUY OR SELL STOCKS.  THE STOCK PRICES WILL"
134  PRINT "BE GENERATED RANDOMLY AND THEREFORE THIS MODEL DOES NOT"
135  PRINT "REPRESENT EXACTLY WHAT HAPPENS ON THE EXCHANGE.  A TABLE"
136  PRINT "OF AVAILABLE STOCKS, THEIR PRICES, AND THE NUMBER OF SHARES"
137  PRINT "IN YOUR PORTFOLIO WILL BE PRINTED.  FOLLOWING THIS, THE"
138  PRINT "INITIALS OF EACH STOCK WILL BE PRINTED WITH A QUESTION"
139  PRINT "MARK.  HERE YOU INDICATE A TRANSACTION.  TO BUY A STOCK"
140  PRINT "TYPE +NNN, TO SELL A STOCK TYPE -NNN, WHERE NNN IS THE"
141  PRINT "NUMBER OF SHARES.  A BROKERAGE FEE OF 1% WILL BE CHARGED"
142  PRINT "ON ALL TRANSACTIONS.  NOTE THAT IF A STOCK'S VALUE DROPS"
143  PRINT "TO ZERO IT MAY REBOUND TO A POSITIVE VALUE AGAIN.  YOU"
144  PRINT "HAVE $10,000 TO INVEST.  USE INTEGERS FOR ALL YOUR INPUTS."
145  PRINT "(NOTE:  TO GET A 'FEEL' FOR THE MARKET RUN FOR AT LEAST"
146  PRINT "10 DAYS)"
147  PRINT "-----GOOD LUCK!-----"
200 REM GENERATION OF STOCK TABLE; INPUT REQUESTS
210 REM INITIAL STOCK VALUES
220  LET S(1)=100
230  LET S(2)=85
240  LET S(3)=150
250  LET S(4)=140
```

```
260  LET S(5)=110
265 REM INITIAL T8 - # DAYS FOR FIRST TREND SLOPE (A)
266  LET T8=INT(4.99*RND(X)+1)
267 REM RANDOMIZE SIGN OF FIRST TREND SLOPE (A)
268  IF RND(X)>.5 THEN 270
269  LET A=-A
270 REM RANDOMIZE INITIAL VALUES
280  GOSUB 830
285 REM INITIAL PORTFOLIO CONTENTS
290  FOR I=1 TO 5
300  LET P(I)=0
305  LET Z(I)=0
310  NEXT I
320  PRINT
330  PRINT
333 REM INITIALIZE CASH ASSETS:C
335  LET C=10000
338 REM PRINT INITIAL PORTFOLIO
340  PRINT "STOCK","  ","INITIALS","PRICE/SHARE"
350  PRINT "INT. BALLISTIC MISSILES","  IBM",S(1)
352  PRINT "RED CROSS OF AMERICA","  RCA",S(2)
354  PRINT "LICHTENSTEIN, BUMRAP & JOKE","  LBJ",S(3)
356  PRINT "AMERICAN BANKRUPT CO.","  ABC",S(4)
358  PRINT "CENSURED BOOKS STORE","  CBS",S(5)
360  PRINT
361 REM NYSE AVERAGE:Z5; TEMP. VALUE:Z4; NET CHANGE:Z6
363  LET Z4=Z5
364  LET Z5=0
365  LET T=0
370  FOR I=1 TO 5
375  LET Z5=Z5+S(I)
380  LET T=T+S(I)*P(I)
390  NEXT I
391  LET Z5=INT(100*(Z5/5)+.5)/100
392  LET Z6=INT((Z5-Z4)*100+.5)/100
393 REM TOTAL ASSETS:D
394  LET D=T+C
395  IF X9>0 THEN 398
396  PRINT "NEW YORK STOCK EXCHANGE AVERAGE: "Z5
397  GO TO 399
398  PRINT "NEW YORK STOCK EXCHANGE AVERAGE: "Z5"   NET CHANGE: "Z6
399  PRINT
400  LET T=INT(100*T+.5)/100
401  PRINT "TOTAL STOCK ASSETS ARE    $";T
403  LET C=INT(100*C+.5)/100
405  PRINT "TOTAL CASH ASSETS ARE     $";C
407  LET D=INT(100*D+.5)/100
408  PRINT "TOTAL ASSETS ARE          $";D
410  PRINT
411  IF X9=0 THEN 416
```


© Copyright 1971, Polytechnic Institute of Brooklyn

```
412  PRINT "DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)";
413  INPUT Q9
414  IF Q9<1 THEN 996
416 REM INPUT TRANSACTIONS
420  PRINT "WHAT IS YOUR TRANSACTION IN"
430  PRINT "IBM";
440  INPUT Z(1)
450  PRINT "RCA";
460  INPUT Z(2)
470  PRINT "LBJ";
480  INPUT Z(3)
490  PRINT "ABC";
500  INPUT Z(4)
510  PRINT "CBS";
520  INPUT Z(5)
525  PRINT
530 REM TOTAL DAY'S PURCHASES IN $:P5
540  LET P5=0
550 REM TOTAL DAY'S SALES IN $:S5
560  LET S5=0
570  FOR I=1 TO 5
575  LET Z(I)=INT(Z(I)+.5)
580  IF Z(I)<=0 THEN 610
590  LET P5=P5+Z(I)*S(I)
600  GO TO 620
610  LET S5=S5-Z(I)*S(I)
612  IF -Z(I)<=P(I) THEN 620
614  PRINT "YOU HAVE OVERSOLD A STOCK; TRY AGAIN."
616  GO TO 420
620  NEXT I
622 REM TOTAL VALUE OF TRANSACTIONS:T5
625  LET T5=P5+S5
630 REM BROKERAGE FEE:B5
640  LET B5=INT(.01*T5*100+.5)/100
650 REM CASH ASSETS=OLD CASH ASSETS-TOTAL PURCHASES
652 REM -BROKERAGE FEES+TOTAL SALES:C5
654  LET C5=C-P5-B5+S5
656  IF C5>=0 THEN 674
658 PRINT "YOU HAVE USED $"-C5" MOR
E THEN YOU HAVE."
660 GO TO 420
674  LET C=C5
675 REM CALCULATE NEW PORTFOLIO
680  FOR I=1 TO 5
690  LET P(I)=P(I)+Z(I)
700  NEXT I
710 REM CALCULATE NEW STOCK VALUES
720  GOSUB 830
750 REM PRINT PORTFOLIO
```

```
751 REM BELL RINGING-DIFFERENT ON MANY COMPUTERS
752  FOR I=1 TO 20
753  PRINT CHR$(135);
754  NEXT I
755  PRINT
756  PRINT "**********  END OF DAY'S TRADING"
757  PRINT
758  PRINT
759  IF A9<1 THEN 769
769  PRINT "STOCK","PRICE/SHARE","HOLDINGS","VALUE","NET PRICE CHANGE"
770  PRINT "IBM", S(1), P(1), S(1)*P(1), C(1)
771  PRINT "RCA", S(2), P(2), S(2)*P(2), C(2)
772  PRINT "LBJ", S(3), P(3), S(3)*P(3), C(3)
773  PRINT "ABC", S(4), P(4), S(4)*P(4), C(4)
774  PRINT "CBS", S(5), P(5), S(5)*P(5), C(5)
775  LET A9=1
780  PRINT
790  PRINT
810  GO TO 360
829 REM NEW STOCK VALUES - SUBROUTINE
830 REM RANDOMLY PRODUCE NEW STOCK VALUES BASED ON PREVIOUS
831 REM DAY'S VALUES
832 REM N1,N2 ARE RANDOM NUMBERS OF DAYS WHICH RESPECTIVELY
833 REM DETERMINE WHEN STOCK I1 WILL INCREASE 10 PTS. AND STOCK
834 REM I2 WILL DECREASE 10 PTS.
840 REM IF N1 DAYS HAVE PASSED, PICK AN I1, SET E1, DETERMINE NEW N1
841  IF N1>0 THEN 850
845  LET I1=INT(4.99*RND(X)+1)
846  LET N1=INT(4.99*RND(X)+1)
847  LET E1=1
850 REM IF N2 DAYS HAVE PASSED, PICK AN I2, SET E2, DETERMINE NEW N2
851  IF N2>0 THEN 860
855  LET I2=INT(4.99*RND(X)+1)
856  LET N2=INT(4.99*RND(X)+1)
857  LET E2=1
860 REM DEDUCT ONE DAY FROM N1 AND N2
861  LET N1=N1-1
862  LET N2=N2-1
890 REM LOOP THROUGH ALL STOCKS
900  FOR I=1 TO 5
910  LET X1=RND(X)
915  IF X1>.25 THEN 920
916  LET X1=.25
917  GO TO 935
920  IF X1>.50 THEN 925
921  LET X1=.50
922  GO TO 935
925  IF X1>.75 THEN 930
926  LET X1=.75
927  GO TO 935
```


© Copyright 1971, Polytechnic Institute of Brooklyn

```
930  LET X1=0.0
931 REM BIG CHANGE CONSTANT:W3  (SET TO ZERO INITIALLY)
935  LET W3=0
936  IF E1<1 THEN 945
937  IF INT(I1+.5)<>INT(I+.5) THEN 945
938 REM ADD 10 PTS. TO THIS STOCK;  RESET E1
939  LET W3=10
943  LET E1=0
945  IF E2<1 THEN 955
947  IF INT(I2+.5)<>INT(I+.5) THEN 955
948 REM SUBTRACT 10 PTS. FROM THIS STOCK;  RESET E2
949  LET W3=W3-10
953  LET E2=0
954 REM C(I) IS CHANGE IN STOCK VALUE
955  LET C(I)=INT(A*S(I))+X1+INT(3-6*RND(X)+.5)+W3
956  LET C(I)=INT(100*C(I)+.5)/100
957  LET S(I)=S(I)+C(I)
960  IF S(I)>0 THEN 967
964  LET C(I)=0
965  LET S(I)=0
966  GO TO 970
967  LET S(I)=INT(100*S(I)+.5)/100
970  NEXT I
972 REM AFTER T8 DAYS RANDOMLY CHANGE TREND SIGN AND SLOPE
973  LET T8=T8-1
974  IF T8<1 THEN 985
980  RETURN
985 REM RANDOMLY CHANGE TREND SIGN AND SLOPE (A), AND DURATION OF
986 REM OF TREND (T8)
990  LET T8=INT(4.99*RND(X)+1)
992  LET A=INT((RND(X)/10)*100+.5)/100
993  LET S4=RND(X)
994  IF S4<=.5 THEN 997
995  LET A=-A
997  RETURN
998  PRINT "HOPE YOU HAD FUN!!"
999  END
```

DESCRIPTION:

This program will average any number of grades. A passing grade must be inputed by the teacher, and the computer will list the numerical value of the curve and the respective adjusted grades.

```
600 DATA 65,78,76,48,65,78,88,69,71,56,90,67,59,60,70,74,62,57,66
601 DATA 64,63,65,59,60,56,48,66
RUN

PASSING GRADE FOR THIS TEST IS ? 70

THE AVERAGE OF ALL GRADES ENTERED IS 65.7037 .

THE AVERAGE FALLS BELOW THE PASSING GRADE BY 4  POINTS.
(ROUNDED TO NEAREST WHOLE NUMBER.)

ADJUSTED GRADE = ORIGINAL GRADE + 4
```

STUDENT NUMBER	ORIGINAL GRADE	ADJUSTED GRADE
1	65	69
2	78	82
3	76	80
4	48	52
5	65	69
6	78	82
7	82	86
8	69	73
9	71	75
10	56	60
11	90	94
12	67	71
13	59	63
14	60	64
15	70	74
16	74	78
17	62	66
18	57	61
19	66	70
20	64	68
21	63	67
22	65	69
23	59	63
24	60	64
25	56	60
26	48	52
27	66	70

```
READY
```

```
100REM COURT, G.M., WALT WHITMAN H.S., REVISED 8/69
105 REM  REVISED BY C.LOSIK  8-26-70
110REM
120REM PROGRAM AVERAGES ANY NUMBER OF GRADES. FOR CURVING PURPOSES
130REM YOU ARE ASKED FOR A PASSING GRADE. IF THE AVERAGE FALLS BELOW
140REM THAT THE DIFFERENCE WILL BE PRINTED OUT AS WELL AS NEWLY CAL-
150REM CULATED GRADES FOR EACH STUDENT. REMEMBER THAT THIS TYPE OF
160REM CURVING IS VALID ONLY IF THE ORIGINAL GRADE DISTRIBUTION
170REM SHOWED A BELL CURVE.
180REM
190REM ENTER GRADES ON DATA LINES 600-700.
200REM
220READX
230IFX=9999THEN260
240LETN=N+1
250GOTO220
260RESTORE
270LETG=0
280PRINT"PASSING GRADE FOR THIS TEST IS ";
290INPUTP
300FORT=1TON
310READA
320LETG=G+A
330NEXTT
340 LET M=G/N
350PRINT
360PRINT"THE AVERAGE OF ALL GRADES ENTERED IS"M"."
365 LET D=0
370IFM>=PTHEN410
380PRINT
390LETD=INT(P-M+.5)
400PRINT"THE AVERAGE FALLS BELOW THE PASSING GRADE BY"D" POINTS."
405 PRINT "(ROUNDED TO NEAREST WHOLE NUMBER.)"
410RESTORE
415 PRINT
417 PRINT "ADJUSTED GRADE = ORIGINAL GRADE +"D
420PRINT
430PRINT"STUDENT","ORIGINAL","ADJUSTED"
440PRINT"NUMBER"," GRADE"," GRADE"
450PRINT"=======","========","========"
460FORX=1TON
470READA
490 PRINT X,A,A+D
500NEXTX
600 DATA 65,78,76,48,65,78,88,69,71,56,90,67,59,60,70,74,68,57,66
601 DATA 64,63,65,59,60,56,48,66
701DATA9999
999END
```


© Copyright 1971, Polytechnic Institute of Brooklyn

DESCRIPTION:

This program will sort and average from 3 to 10 grades, for up to 35 students.

Data is entered in lines 600-609. The data are entered in order of student number for the first test, followed by the grades for the second test in order of student number, followed by the grades on the third test in order of student number, etc.

The program prints a table listing the grades for each student and his average.

```
600 DATA 0,70,72,59,66,70,75,100,77,65
601 DATA 50,65,70,68,70,75,70,65,70,70
602 DATA 75,80,85,90,95,85,85,90,92,87
603 DATA 65,70,75,85,87,77,86,90,75,64
604 DATA 65,70,75,90,85,71,78,89,85,75
605 DATA 75,80,80,80,85,75,90,89,78,67
606 DATA 75,70,80,55,59,67,78,54,76,34
607 DATA 75,75,68,90,95,87,54,67,86,78
608 DATA 80,90,55,75,64,66,86,90,96,78
609 DATA 55,69,78,90,0,0,76,97,56,75

READY

RUN

 NUMBER OF STUDENTS IN CLASS IS --- ? 10
NUMBER OF GRADES TO BE AVERAGED IS --- ? 10


STUD.                          GRADES
 NO.          (LAST COLUMN LISTS AVERAGES)
 1     0     50    75    65    65    75    75    75    80    55    68.3
 2     70    65    80    70    70    80    70    75    90    69    73.9
 3     72    70    85    75    75    80    80    68    55    78    73.8
 4     59    68    90    85    90    80    55    90    75    90    78.2
 5     66    70    95    87    85    85    59    95    64    0     78.4
 6     70    75    85    77    71    75    67    87    66    0     74.8
 7     75    70    85    86    78    90    78    54    86    76    77.8
 8     100   65    90    90    89    89    54    67    90    97    83.1
 9     77    70    92    75    85    78    76    86    96    56    79.5
 10    65    70    87    64    75    67    34    78    78    75    69.3

READY
```

```
100REM PEREZ-COURT, WALT WHITMAN H.S., 7/69
110 REM REVISED 10/70 BY DAVID SOBIN - POLYTECH
120REM
130REM PROGRAM SORTS AND AVERAGES FROM 3 TO 10 GRADES FOR UP TO 35
140REM STUDENTS. THEY ARE THEN PRINTED OUT. THE GRADES MAY BE FROM
150REM TESTS OR QUARTERLY AVERAGES.
160REM
170 REM  NOTE: THE NUMBER OF GRADES PER STUDENT TIMES THE NUMBER
180 REM OF STUDENTS MUST NOT EXCEED 295.
190 REM
200REM THE GRADES ARE ENTERED IN THE SAME ORDER FOR EACH TEST OR
210REM QUARTER, FROM STUDENT NUMBER ONE TO THE LAST IN THE CLASS. THE
220REM PROGRAM WILL SORT OUT AND AVERAGE THE GRADES FOR EACH STUDENT
230REM SEPARATELY. IF A GRADE IS MISSING FOR ANY STUDENT, A ZERO MUST
240REM BE ENTERED. THESE WILL NOT BE AVERAGED IN. IF YOU WANT TO AVERAGE
250REM IN A ZERO AS A GRADE, ENTER A GRADE OF 1 INSTEAD. IT WILL NOT
260REM AFFECT THE AVERAGE SIGNIFICANTLY.
270REM
280REM REMEMBER TO ENTER THE SAME NUMBER OF GRADES FOR EACH STUDENT IN
290REM THE ORDER PRESCRIBED ABOVE. IF THIS IS NOT DONE, THE GRADES
300REM AND AVERAGES WHICH ARE PRINTED OUT WILL NOT BE CORRECT.
310REM
320PRINT" NUMBER OF STUDENTS IN CLASS IS --- ";
330 INPUT N
340 PRINT "NUMBER OF GRADES TO BE AVERAGED IS --- ";
350 INPUT G
360 FOR I=1 TO N*G
370 READ X
380 IF X=9999 THEN 1020
390 NEXT I
400 READ X
410 IF X<>9999 THEN 1020
420 PRINT
430 PRINT
440 PRINT
450 PRINT "STUD.","              GRADES"
460 PRINT " NO.           (LAST COLUMN LISTS AVERAGES)"
470 RESTORE
480 FOR I=1 TO  N
490 PRINT I;
500 GOSUB 850
510 LET S=0
520 LET Z=0
530 IF I=1 THEN 570
540 FOR J=1 TO I-1
550 READ X
560 NEXT J
570 FOR K=1 TO G
580 READ X
```


© Copyright 1971, Polytechnic Institute of Brooklyn

```
590 IF A<>0 THEN 720
600 DATA 0,70,72,59,66,70,75,100,77,65
601 DATA 50,65,70,68,70,75,70,65,70,70
602 DATA 75,80,85,90,95,85,85,90,92,87
603 DATA 65,70,75,85,87,77,86,90,75,64
604 DATA 65,70,75,90,85,71,78,89,85,75
605 DATA 75,80,80,80,85,75,90,89,78,67
606 DATA 75,70,80,55,59,67,78,54,76,34
607 DATA 75,75,68,90,95,87,54,67,86,78
608 DATA 80,90,55,75,64,66,86,90,96,78
609 DATA 55,69,78,90,0,0,76,97,56,75
700 DATA 9999
710 LET Z=Z+1
720 LET S=S+A
730 PRINT A;
740 GOSUB 900
750 IF A=G THEN 790
760 FOR L=1 TO N-1
770 READ A
780 NEXT L
790 NEXT A
800 LET S=S/(G-Z)
810 PRINT INT(10*S+.5)/10
820 RESTORE
830 NEXT I
840 STOP
850 IF I<10 THEN 860
860 GOSUB 990
870 RETURN
880 GOSUB 960
890 RETURN
900 IF A<10 THEN 940
910 IF A<100 THEN 960
930 RETURN
940 GOSUB 980
950 RETURN
960 GOSUB 990
970 RETURN
980 PRINT " ";
990 PRINT" ";
1010 RETURN
1020 PRINT "CHECK YOUR DATA LINES. YOUR ENTRIES DO NOT SHOW"
1030 PRINT "THE SAME NUMBER OF GRADES FOR EACH STUDENT."
1040 END
```

DESCRIPTION:

This program prints a frequency distribution (bar graphs) of grades, for a single test for one or more classes, or for several tests for one student.

```
600 DATA 25,30,35,40,45,50,55,60,65,70,75,80,85,90,95,100
601 DATA 35,40,45,50,55,60,65,70,75,80,85,90,95
602 DATA 50,55,60,65,70,75,80,85,90
603 DATA 55,60,65,70,75,80,85
604 DATA 60,65,70,75,80,85
605 DATA 65,70,75,80
606 DATA 65,70,75,80
607 DATA 70,75

READY

RUN

          GRADE FREQUENCY DISTRIBUTION (BAR GRAPH)
          ----------------------------------------

GRADE          1    5    10    15    20    25    30
-----         I+---+----+-----+----+----+-----+
 0            I
 5            I
 10           I
 15           I
 20           I
 25           IX
 30           IX
 35           IXX
 40           IXX
 45           IXX
 50           IXXX
 55           IXXXX
 60           IXXXXX
 65           IXXXXXXX
 70           IXXXXXXXX
 75           IXXXXXXXX
 80           IXXXXXXX
 85           IXXXXX
 90           IXXX
 95           IXX
 100          IX

READY
```


© Copyright 1971, Polytechnic Institute of Brooklyn

```
100REM PEREZ, WALT WHITMAN H.S., REVISED 7/69
105 REM  REVISED BY C.LOSIK  8-26-70
110REM
120REM THIS PROGRAM PRINTS A FREQUENCY DISTRIBUTION OF GRADES.
130REM ENTRIES ARE ROUNDED OFF TO THE NEAREST 5 AND INDICATED ON A
140REM BAR GRAPH. IT MAY BE USED FOR A SINGLE TEST FOR ONE OR MORE
150REM CLASSES OR FOR SEVERAL TESTS FOR ONE STUDENT. THE PROGRAM IS
160REM SET TO ACCEPT UP TO 150 GRADES. LINES 600-700 ARE SET ASIDE
170REM FOR DATA ENTRIES. THEY MAY BE ENTERED IN ANY SEQUENCE.
180REM
190PRINT"          GRADE FREQUENCY DISTRIBUTION (BAR GRAPH)"
200PRINT"          ----------------------------------------"
210PRINT
220PRINT"GRADE"," 1    5    10    15    20    25    30"
230PRINT"-----","I+----+----+----+----+----+----+"
240 DIM F(150),P(100)
250READF
260IFF=9999THEN290
270LETN=N+1
280GOTO250
290RESTORE
292 IF N<=150 THEN 300
294 PRINT "RE-DIMENSION LINE 240.  DELETE LINES 292,294,296."
296 STOP
300FORI=1TON
310READF(I)
320LETF(I)=5*INT(F(I)/5+.5)
330NEXTI
340FORI=1TON
350FORP=0TO100STEP5
360IFP=F(I)THEN380
370NEXTP
380LETP(P)=P(P)+1
390NEXTI
400PRINT" 0","I"
410FORP=5TO100STEP5
420PRINTP,"I";
430IFP(P)>=1THEN460
440 PRINT " "
450GOTO500
460FORL=1TOP(P)
470PRINT"X";
480NEXTL
490 PRINT " "
500NEXTP
600REM BEGIN DATA ENTRIES HERE. TYPE - 600 DATA 1,2,3, ETC.
701DATA9999
999END
```

DESCRIPTION:

This program is useful in determining the grade of an examination consisting of several examples. By inputing the number of incorrect answers, the corresponding grade in percent and the number of correct answers.

```
NUMBER OF QUESTIONS IN THIS TEST IS ? 15

NUMBER                          NUMBER
WRONG          GRADE            RIGHT
------         -----            ------
 0              100              15
 1              93               14
 2              87               13
 3              80               12
 4              73               11
.....................................
 5              67               10
 6              60               9
 7              53               8
 8              47               7
 9              40               6
.....................................
 10             33               5
 11             27               4
 12             20               3
 13             13               2
 14             7                1
.....................................
 15             0                0
```


© Copyright 1971, Polytechnic Institute of Brooklyn

```
100REM PEREZ-COURT, WALT WHITMAN H.S., REVISED 8/69
105 REM  REVISED BY C.LOSIK  8-26-70
110REM
120REM THIS PROGRAM PRINTS OUT THE GRADES OF STUDENTS, IN PERCENTAGES,
130REM NEXT TO THE NUMBER OF QUESTIONS MISSED ON A TEST AND THE
140REM NUMBER ANSWERED CORRECTLY. WHEN THE QUESTION MARK APPEARS , TYPE
150REM IN THE NUMBER OF QUESTIONS ON THE TEST AND HIT THE RETURN KEY.
160REM
170PRINT"NUMBER OF QUESTIONS IN THIS TEST IS ";
180INPUTA
190PRINT
200PRINT"NUMBER                              NUMBER"
210PRINT"WRONG          GRADE                RIGHT"
220PRINT"------         -----                ------"
230FORX=0TOA
240LETZ=Z+1
250LETG=INT((100-(X*100/A))+.5)
260IFG<0THEN330
270PRINTX,G,(A-X)
280IFZ=5THEN300
290NEXTX
295 GO TO 330
300PRINT"....................................."
310LETZ=0
320GOTO290
330END
```

DESCRIPTION:

This program counts and prints the number of times questions are missed on a test.

```
600 DATA 1,2,3,4,5,2,3,5,6,7,8,9,10,7,8,9,11,13,14,15,10,13,15,10
RUN

                ITEM ANALYSIS
                -------------

NUMBER OF QUESTIONS IN THE TEST IS? 15

QUESTION            NUMBER OF TIMES MISSED
--------            ----------------------
   1                          1
   2                          2
   3                          2
   4                          1
   5                          2
   6                          1
   7                          2
   8                          2
   9                          2
  10                          3
  11                          1
  12                          0
  13                          2
  14                          1
  15                          2

READY
```


© Copyright 1971, Polytechnic Institute of Brooklyn

```
100REM PEREZ-COURT, WALT WHITMAN H.S., REVISED 7/69
105 REM  REVISED BY C.LOSIK  8-26-70
110REM
120REM PROGRAM COUNTS AND PRINTS NUMBER OF TIMES QUESTIONS ARE MISSED ON
130REM A TEST. THE NUMBERS OF THE QUESTIONS MISSED ARE ENTERED ON DATA
140REM LINES 600-700. UP TO 200 ITEMS MAY BE ENTERED IN ANY ORDER.
150REM YOU MIGHT , FOR EXAMPLE, FEED IN THE NUMBERS OF THE QUESTIONS
160REM MISSED BY ONE STUDENT, GO ON TO THE NEXT STUDENT, ETC., UNTIL ALL
170REM QUESTIONS MISSED BY A CLASS OR ALL CLASSES HAVE BEEN ENTERED.
180REM
185 REM
190 PRINT " ","ITEM ANALYSIS"
200 PRINT " ","-------------"
205 PRINT
210DIMP(200)
220READX
230IFX=9999THEN260
240LETN=N+1
250GOTO220
260RESTORE
262 IF N<=200 THEN 268
264 PRINT "RE-DIMENSION THE ARRAY. DELETE LINES 262,264,266."
266 STOP
268 PRINT "NUMBER OF QUESTIONS IN THE TEST IS";
270INPUTQ
272 PRINT
274 PRINT "QUESTION","      NUMBER OF TIMES MISSED"
276 PRINT "--------","      ----------------------"
280FORI=1TON
290READX
300FORP=1TOQ
310IFP=XTHEN330
320NEXTP
330LETP(P)=P(P)+1
340NEXTI
350FORP=1TOQ
360 PRINT "  "P," ",P(P)
390NEXTP
600 DATA 1,2,3,4,5,2,3,5,6,7,8,9,10,7,8,9,11,13,14,15,10,13,15,10
701DATA9999
999END
```

DESCRIPTION:

This program will sum item analysis for up to five classes. Question numbers and number of students missing will each be printed out, as well as a validity based on between 30 and 70 percent of the students answering that question correctly.

```
600 DATA 1,5,3,6,2,1,5,3,8,4,3,6,10,13,5
601 DATA 3,5,2,4,2,2,7,5,10,4,3,4,12,14,3
602 DATA 0,3,2,5,0,2,5,5,10,1,2,9,14,14,1
603 DATA 2,2,1,3,1,0,4,4,6,3,1,6,10,11,1
RUN

        08-15-69

                    CUMULATIVE ITEM ANALYSIS
                    ------------------------

NUMBER OF QUESTIONS IN TEST IS ---?15
NUMBER OF CLASSES ENTERED IS ---?4
NUMBER OF STUDENTS TAKING TEST IS ---?60

* VALID=BETWEEN 30 AND 70 PER CENT ANSWERED QUESTION CORRECTLY

QUESTIONS                   CLASSES
---------                   -------
                1     2     3     4     5     TOTAL MISSED
                ---------------------------------------------
1               1     3     0     2           6
2               5     5     3     2           15
3               3     2     2     1           8
4               6     4     5     3           18    * VALID
5               2     2     0     1           5
6               1     2     2     0           5
7               5     7     5     4           21    * VALID
8               3     5     5     4           17
9               8     10    10    6           34    * VALID
10              4     4     1     3           12
11              3     3     2     1           9
12              6     4     9     6           25    * VALID
13              10    12    14    10          46
14              13    14    14    11          52
15              5     3     1     1           10

READY
```


© Copyright 1971, Polytechnic Institute of Brooklyn

```
100REM COURT, C.M., WALT WHITMAN H.S., REVISED 8/69
110REM
120REM PROGRAM SUMS ITEM ANALYSES FOR UP TO 5 CLASSES. QUESTION
130REM NUMBERS AND NUMBER OF STUDENTS MISSING EACH WILL BE PRINTED OUT
140REM AS WELL AS A VALIDITY BASED ON BETWEEN 30 AND 70 PERCENT OF THE
150REM STUDENTS ANSWERING THAT QUESTION CORRECTLY. THIS MAY BE BY-PASSED
160REM BY TYPING IN 999 FOR NUMBER OF STUDENTS TAKING TEST.
170REM
180REM
190REM DATA LINES 600-700 HAVE BEEN SET ASIDE FOR ENTRIES. A NUMBER
200REM MUST BE ENTERED FOR EACH QUESTION, IN SEQUENCE, FOR EACH CLASS.
210REM IF NO STUDENT MISSED A PARTICULAR QUESTION, ENTER 0 (ZERO). IT
220REM WOULD BE WISE TO BEGIN ENTRIES OF A NEW CLASS ON A NEW DATA
230REM LINE FOR EASIER VERIFICATION SHOULD AN ERROR OCCUR.
240REM
250DIMA(50),B(50),C(50),D(50),E(50)
260LETS=0
270PRINT"                    CUMULATIVE ITEM ANALYSIS"
280PRINT"                    ------------------------"
290PRINT
300PRINT"NUMBER OF QUESTIONS IN TEST IS ---";
310INPUTQ
320PRINT"NUMBER OF CLASSES ENTERED IS ---";
330INPUTN
340IFN<1THEN790
350IFN>5THEN790
360PRINT"NUMBER OF STUDENTS TAKING TEST IS ---";
370INPUTR
380READX
390IFX=9999THEN420
400LETS=S+1
410GOTO380
420RESTORE
430IFS=0*NTHEN450
440GOSUB805
450LETT1=0
460FORI=1TOQ
470READA(I)
480NEXTI
490GOSUB760
500FORI=1TOQ
510READB(I)
520NEXTI
530GOSUB760
540FORI=1TOQ
550READC(I)
560NEXTI
570GOSUB760
580FORI=1TOQ
590READD(I)
592NEXTI
600REM BEGIN YOUR DATA ENTRIES HERE. TYPE - 600 DATA 1,2,3, ETC.
701DATA9999
710GOSUB760
720FORI=1TOQ
730READE(I)
740NEXTI
750GOSUB760
760LETT1=T1+1
770IFT1=NTHEN850
780RETURN
```

```
790PRINT"PROGRAM WILL ANALIZE FROM 1 TO 5 CLASSES ONLY."
800GOTO330
805PRINT
810PRINT"THERE MUST BE ONE NUMBER ENTERED FOR EACH QUESTION FOR EACH"
820PRINT"CLASS. REMEMBER, A ZERO IS ENTERED IF NO STUDENT MISSED "
830PRINT"A PARTICULAR QUESTION. CHECK YOUR DATA LINES."
840GOTO1390
850IFR=999THEN880
860PRINT
870PRINT"* VALID=BETWEEN 30 AND 70 PER CENT ANSWERED QUESTION CORRECTLY"
880PRINT
890PRINT"QUESTIONS","             CLASSES"
900PRINT"---------","             -------"
910PRINT" "," 1     2     3     4     5     TOTAL MISSED"
920PRINT" ","-------------------------------------------"
930FORJ=1TO0
940PRINTJ,
950LETZ=A(J)
960GOSUB1320
970GOSUB1060
980IFT>INT((.7*R)+.5)THEN1020
990IFT<INT((.3*R)+.5)THEN1020
1000PRINT"* VALID"
1010GOTO1030
1020PRINT
1030LETT=0
1040NEXTJ
1050GOTO1390
1060LETT=A(J)
1070IFN>1THEN1130
1080FORI=1TO(5-N)
1090PRINT"        ";
1100NEXTI
1110PRINTT;
1120GOTO980
1130LETZ=B(J)
1140GOSUB1320
1150LETT=T+B(J)
1160IFN>2THEN1180
1170GOTO1080
1180LETZ=C(J)
1190GOSUB1320
1200LETT=T+C(J)
1210IFN>3THEN1230
1220GOTO1080
1230LETZ=D(J)
1240GOSUB1320
1250LETT=T+D(J)
1260IFN>4THEN1280
1270GOTO1080
1280LETZ=D(J)
1290GOSUB1320
1300LETT=T+E(J)
1310GOTO1110
1320PRINTZ;
1330IFZ>99THEN1380
1340IFZ>9THEN1370
1350IFZ>-1THEN1360
1360PRINT" ";
1370PRINT" ";
1380RETURN
1390END
```


© Copyright 1971, Polytechnic Institute of Brooklyn

DISCIPLINE TEACHER ASSISTANCE

SUBJECT LABORATORY DATA

PROGRAM NAME STAT

DESCRIPTION:

This program treats class sets of laboratory data statistically. Aside from a table of experimental values with errors and percent errors, the teacher has a choice of experimental value distribution with bar graph, ranking by percent error, ranking by experimental value, mean deviation, and standard deviation.

OBJECTIVES:

A. To make percent error in experiments more meaningful.

B. To increase competitive spirit in the laboratory due to ranking portion of statistical analysis.

C. To provide a basis for further discussion of laboratory data and techniques.

PRELIMINARY PREPARATION:

This program is not generally for student use.

DISCUSSION:

Often a teacher is forced to work with some arbitrary percent error scale for marking purposes. With a statistical analysis of the laboratory results, a realistic scale can easily be developed.

Also, it is often desireable to discuss the class results but without a statistical analysis this usually turns out to be rather shallow. The analysis can now be obtained in the few minutes it takes the students to clean their equipment and put it away.

It may be helpful to discuss a few of the ways in which the teacher can input data. First, the teacher may simply call up the program and then either he or his students can input the data as the experiments are finished. Next, with the teletype unit on local, a tape can be made and the analysis can be made at any convenient time. With tapes a teacher can do a statistical analysis of his classes separately or as a group as long as each student gets a different student number.

THIS PROGRAM WILL DO THE FOLLOWING:

1. PRINT OUT A TABLE OF EXPERIMENTAL VALUES, ERRORS, AND PERCENT ERRORS INCLUDING AVERAGES FOR ALL.
2. GIVE YOU A CHOICE OF ALL OF THE FOLLOWING:
   - CHOICE 1 - EXPERIMENTAL VALUE DISTRIBUTION INCLUDING A BAR GRAPH
   - CHOICE 2 - RANKING BY PERCENT ERROR
   - CHOICE 3 - RANKING BY EXPERIMENTAL VALUE
   - CHOICE 4 - OTHER INFORMATION
   - CHOICE 5 - ALL OF THE ABOVE CHOICES
   - CHOICE 6 - ENDS PROGRAM

INSTRUCTIONS

1. LINES 100 TO 110 HAVE BEEN RESERVED FOR DATA.
2. NOTE: THE FIRST DATA LINE MUST ALWAYS BE NO. 100 AND LINE 101 MUST ALWAYS BE USED.
3. THERE IS ROOM FOR DATA FOR A MAXIMUM OF 60 STUDENTS.
4. INPUT SHOULD BE IN THE FORM:
   100 DATA STUDENT NO., VALUE, STUDENT NO., VALUE, ETC.,
5. STUDENT NUMBERS MUST RANGE FROM 1-60.
6. OLD DATA IS ERASED BY INPUTING NEW DATA WITH THE SAME LINE NUMBERS DURING SUBSEQUENT RUNS.
7. IF THE FIRST RUN REQUIRES DATA LINES 100-110 AND THE SECOND RUN REQUIRES LINES 100-109, LINE 110 IS TYPED IN TO ERASE OLD DATA IN THAT LINE.
8. NEVER TYPE SAVE DURING THE RUN OF ANY PART OF THIS PROGRAM.

TIME: 3 SECS.

```
TAPE
READY.

100 DATA 1,37.8,2,38.6,3,39.7,4,37.9,5,38.0,6,40.6,7,41.8,8,37.6,9,
101 DATA 39.5,10,40.1,11,39.8,12,39.4,13,35.4,14,33.9,15,42.0,16,39.6,
102 DATA 17,38.7,18,37.6,19,38.5,20,40.1

RUN
WAIT.
```


© Copyright 1971, Polytechnic Institute of Brooklyn

WHAT IS THE TOTAL NO. OF STUDENTS AND THE CALC. VALUE?20,39.0

DATA LISTED BY STUDENT NUMBER

STUDENT NO.	VALUE	ERROR	PERCENT ERROR
1	37.8	-1.2	3.07692
2	38.6	-.4	1.02564
3	39.7	.7	1.79487
4	37.9	-1.1	2.82051
5	38	-1	2.5641
6	40.6	1.6	4.10256
7	41.8	2.8	7.17949
8	37.6	-1.4	3.58974
9	39.5	.5	1.28205
10	40.1	1.1	2.82051
11	39.8	.8	2.0512
12	39.4	.4	1.02564
13	35.4	-3.6	9.23077
14	33.9	-5.1	13.0769
15	42	3	7.69231
16	39.6	.6	1.53846
17	38.7	-.3	.769231
18	37.6	-1.4	3.58974
19	38.5	-.5	1.28205
20	40.1	1.1	2.82051

THE ARITHMETIC MEAN [AVERAGE] IS 38.83
THE AVERAGE ERROR [ABSOLUTE] IS 1.43
THE AVERAGE PERCENT ERROR IS 3.66667

DO YOU DESIRE ADDITIONAL INFORMATION ? IF SO, TYPE
IN THE NUMBER OF YOUR CHOICE.?5

FOR THE DISTRIBUTION, WHAT LOWER LIMIT, UPPER LIMIT,
AND STEP DO YOU DESIRE ?35,42.5,.5

EXPERIMENTAL VALUE DISTRIBUTION

FROM	TO LESS THAN	NO.	BAR GRAPH
0	35	1	*
35	35.5	1	*
35.5	36	0	
36	36.5	0	
36.5	37	0	
37	37.5	0	
37.5	38	4	****
38	38.5	1	*
38.5	39	3	***
39	39.5	1	*
39.5	40	4	****
40	40.5	2	**
40.5	41	1	*
41	41.5	0	
41.5	42	1	*
42	42.5	1	*
42.5	INFINITY	0	

RANKING BY PERCENT ERROR

RANK	STUDENT NO.	PERCENT ERROR
1	17	.769231
2	12	1.02564
3	2	1.02564
4	9	1.28205
5	19	1.28205
6	16	1.53846
7	3	1.79487
8	11	2.05128
9	5	2.5641
10	10	2.82051
11	20	2.82051
12	4	2.82051
13	1	3.07692
14	8	3.58974
15	18	3.58974
16	6	4.10256
17	7	7.17949
18	15	7.69231
19	13	9.23077
20	14	13.0769

RANKING BY EXPERIMENTAL VALUE

RANK	STUDENT NO.	EXPER. VALUE
1	14	33.9
2	13	35.4
3	8	37.6
4	18	37.6
5	1	37.8
6	4	37.9
7	5	38
8	19	38.5
9	2	38.6
10	17	38.7
11	12	39.4
12	9	39.5
13	16	39.6
14	3	39.7
15	11	39.8
16	10	40.1
17	20	40.1
18	6	40.6
19	7	41.8
20	15	42

OTHER INFORMATION

THE MEDIAN VALUE IS 38.7
THE LOWEST VALUE IS 33.9
THE HIGHEST VALUE IS 42
THE MEAN DEVIATION [AVERAGE DEVIATION] IS .13
THE STANDARD DEVIATION IS 1.87776
THIS CONCLUDES THE RUN.

```
1REMH.DORFMAN,PIB,8/1/69
2 REM STATISTICAL ANALYSIS OF LABORATORY DATA
100  GO TO 1750
101  DATA 0
160DIMA(50),R(50),Y(50),W(50)
170DIMQ(50)
180LETY(0)=0
190FORI=1 TO 50
200LETA(I)=0
210LETR(I)=0
220LETY(I)=0
230LETW(I)=0
240LETQ(I)=0
250NEXTI
260LETA9=0
270LETA8=0
280LETP=0
290LETV=0
300LETC=0
310 PRINT "WHAT IS THE TOTAL NO. OF STUDENTS AND THE CALC. VALUE";
320INPUTB,K
330   PRINT
340FORI=1TOB
350READR(I),A(I)
360NEXTI
370 PRINT "DATA LISTED BY STUDENT NUMBER"
380 PRINT "---- ------ -- ------- ------"
390PRINT
400 PRINT" STUDENT NO.","VALUE","ERROR","PERCENT ERROR"
410 PRINT
420FORI=1TOB
430LETZ=A(I)-K
440LETA8=A8+ABS(Z)/B
450LETP=P+A(I)/B
460LETW(I)=(ABS(Z/K))*100
470LETA9=A9+W(I)/B
480 PRINT R(I),A(I),Z,W(I)
490NEXTI
500PRINT
510 PRINT "THE ARITHMETIC MEAN (AVERAGE) IS    ";P
520 PRINT "THE AVERAGE ERROR (ABSOLUTE) IS     ";A8
530 PRINT "THE AVERAGE PERCENT ERROR IS        ";A9
540PRINT
550PRINT
560 PRINT " DO YOU DESIRE ADDITIONAL INFORMATION ? IF SO, TYPE"
570 PRINT " IN THE NUMBER OF YOUR CHOICE.";
580INPUTN
590IFN=2THEN1010
```

```
600IFN=3THEN1200
610IFN=4THEN1490
620IFN=6THEN1730
630PRINT
640 PRINT "FOR THE DISTRIBUTION, WHAT LOWER LIMIT, UPPER LIMIT,"
650 PRINT "AND STEP DO YOU DESIRE ";
660INPUTE,F,G
670PRINT
680PRINT
690 PRINT "EXPERIMENTAL VALUE DISTRIBUTION"
700 PRINT "------------ ----- ------------"
710PRINT
720FORI=1TOB
730LETM=0
740IFA(I)>=FTHEN850
750IFA(I)>=ETHEN770
760LETY(0)=Y(0)+1
770FORJ=ETO(F-G)STEPG
780LETM=M+1
790IFA(I)>=JTHEN810
800GOTO830
810IFA(I)>=(J+G)THEN830
820LETY(M)=Y(M)+1
830NEXTJ
840GOTO860
850LETY(25)=Y(25)+1
860NEXTI
870LETM=1
880 PRINT "FROM","TO LESS THAN"," NO."," BAR GRAPH"
881 PRINT
882 PRINT 0,E,Y(0),
890LETA5=Y(0)
900GOSUB2000
910FORJ=ETO(F-G)STEPG
920 PRINT J,J+G,Y(M),
930LETA5=Y(M)
940GOSUB2000
950LETM=M+1
960NEXTJ
970 PRINT F,"INFINITY",Y(25),
980LETA5=Y(25)
990GOSUB2000
1000IFN=1THEN540
1010PRINT
1020PRINT
1030 PRINT "RANKING BY PERCENT ERROR"
1040 PRINT "------- -- ------- -----"
1050PRINT
1060 PRINT "RANK","STUDENT NO.","PERCENT ERROR"
1070PRINT
1080FORS=1TOB
1090LETT=1E25
```


© Copyright 1971, Polytechnic Institute of Brooklyn

```
1100FORI=1TOB
1110IFW(I)>=TTHEN1140
1120LETT=W(I)
1130LETV=I
1140NEXTI
1150PRINTS,V,W(V)
1160LETW(V)=1E25
1170NEXTS
1180PRINT
1190IFN=2THEN540
1200PRINT
1210PRINT
1220PRINT
1230 PRINT "RANKING BY EXPERIMENTAL VALUE"
1240 PRINT "------- -- ------------ -----"
1250PRINT
1260 PRINT" RANK","STUDENT NO.","EXPER. VALUE"
1261 PRINT
1270FORS=1TOB
1280LETT=1E25
1290FORI=1TOB
1300IFA(I)>=TTHEN1330
1310LETT=A(I)
1320LETV=I
1330NEXTI
1340PRINTS,V,A(V)
1350LETQ(S)=A(V)
1360LETA(V)=1E25
1370NEXTS
1380LETF=0
1390LETG7=B/2
1400FORI=1TO31
1410IFG7=ITHEN1470
1420NEXTI
1430LETZ2=INT(G7)
1440LETZ4=INT(G7+1)
1450LETF=(Q(Z2)+Q(Z4))/2
1460GOTO1540
1470LETF=(Q(G7))
1480IFN=3THEN540
1490PRINT
1500PRINT
1510 PRINT "OTHER INFORMATION"
1520 PRINT "----- -----------"
1530PRINT
1540 PRINT "THE MEDIAN VALUE IS  ";F
1550 PRINT "THE LOWEST VALUE IS  ";Q(1)
1560 PRINT "THE HIGHEST VALUE IS ";Q(B)
1570LETM=0
1580LETP9=F
1590FORI=1TOB
1600LETP3=Q(I)-P9
1610LETM=M+P3
1620NEXTI
```

```
1630LETM7=M/B
1640 PRINT "THE MEAN DEVIATION (AVERAGE DEVIATION) IS"M7
1650LETM=0
1660FORI=1TOB
1670LETP3=(Q(I)-P9)↑2
1680LETM=M+P3
1690NEXTI
1700LETM7=SQR(M/B)
1710 PRINT "THE STANDARD DEVIATION IS"M7
1720IFN=4THEN540
1730 PRINT " THIS CONCLUDES THE RUN."
1740STOP
1750 PRINT" THIS PROGRAM WILL DO THE FOLLOWING:"
1760 PRINT"     1. PRINT OUT A TABLE OF EXPERIMENTAL VALUES, ERRORS,"
1770 PRINT"        AND PERCENT ERRORS INCLUDING AVERAGES FOR ALL."
1780 PRINT"     2. GIVE YOU A CHOICE OF ALL OF THE FOLLOWING:"
1790 PRINT"             CHOICE 1 - EXPERIMENTAL VALUE DISTRIBUTION"
1791 PRINT"                        INCLUDING A BAR GRAPH"
1800 PRINT"             CHOICE 2 - RANKING BY PERCENT ERROR"
1810 PRINT"             CHOICE 3 - RANKING BY EXPERIMENTAL VALUE"
1820 PRINT"             CHOICE 4 - OTHER INFORMATION"
1830 PRINT"             CHOICE 5 - ALL OF THE ABOVE CHOICES"
1840 PRINT"             CHOICE 6 - ENDS PROGRAM"
1850 PRINT"                    INSTRUCTIONS"
1860 PRINT" 1. LINES 100 TO 159 HAVE BEEN RESERVED FOR DATA."
1870 PRINT" 2. NOTE: THE FIRST DATA LINE MUST ALWAYS BE NO. 100"
1871 PRINT"          AND LINE 101 MUST ALWAYS BE USED."
1880 PRINT" 3. THERE IS ROOM FOR DATA FOR A MAXIMUM OF 50 STUDENTS."
1890 PRINT" 4. INPUT SHOULD BE IN THE FORM:"
1900 PRINT"    100 DATA STUDENT NO., VALUE, STUDENT NO., VALUE, ETC.,"
1910 PRINT" 5. STUDENT NUMBERS MUST RANGE FROM 1-50."
1920 PRINT" 6. OLD DATA IS ERASED BY INPUTING NEW DATA WITH THE SAME"
1930 PRINT"    LINE NUMBERS DURING SUBSEQUENT RUNS."
1940 PRINT" 7. IF THE FIRST RUN REQUIRES DATA LINES 100-110 AND THE"
1950 PRINT"    SECOND RUN REQUIRES LINES 100-109, LINE 110 IS TYPED"
1960 PRINT"    IN TO ERASE OLD DATA IN THAT LINE."
1970 PRINT" 8. NEVER TYPE SAVE DURING THE RUN OF ANY PART OF THIS"
1980 PRINT"    PROGRAM."
1990PRINT
1995STOP
1996FOR I=1 TO A5
1997PRINT"*";
1998NEXTI
1999PRINT
2000RETURN
2001END
```


© Copyright 1971, Polytechnic Institute of Brooklyn

DESCRIPTION:

This program will find the mean, median, and deviation of a set of numbers.

```
            MEAN, MEDIAN, AND DEVIATION OF A SET OF NUMBERS.

ENTER YOUR NUMBERS IN DATA STATEMENTS ON LINES
1000 - 2000.  FOR EXAMPLE, YOU MIGHT TYPE :

            1000 DATA  1,2,3,4  ETC. (YOUR DATA GOES HERE!)

WHEN YOUR DATA HAS BEEN ENTERED,  TYPE :

            1 GO TO 300
            RUN

THEN RELAX WHILE THE MACHINE GRINDS OUT THE ANSWERS.
IF AN 'OUT OF DATA' APPEARS, ADJUST LINE 295.

READY

READY

1000 DATA 244,182,112,2,198,10,314,160,18,38
1 GO TO 300
RUN


 THESE ARE YOUR NUMBERS :
 244   182   112   2   198   10   314   160   18   38

 THESE ARE YOUR NUMBERS (HIGHEST TO LOWEST) :
 314   244   198   182   160   112   38   18   10   2


 NUMBER OF VALUES IS 10
 SUM OF THE VALUES IS 1278
 THE MEAN VALUE IS 127.8
 THE MEDIAN VALUE IS 136
 THE STANDARD DEVIATION IS 208.2797


 FOR ANOTHER RUN, RE-ENTER DATA ON LINES
 1000 - 2000, TAKING CARE TO ELIMINATE OLD DATA
 BY TYPING THOSE LINE NUMBERS WHICH YOU DO NOT USE AGAIN;
 THEN TYPE 'RUN'.


READY

1000
1
```

```
100  REM  CHARLES M. LOSIK, BKLYN POLY, MEAN-MEDIAN-DEVIATION
110  REM  (7-66 IN FORTRAN II) ; (8-26-70 IN BASIC)
120  REM  YOU PUT YOUR NUMBERS IN DATA STATEMENTS AND
130  REM  YOU GET WHAT YOU PAY FOR.
140 PRINT " ","MEAN, MEDIAN, AND DEVIATION OF A SET OF NUMBERS."
150 PRINT
160 PRINT " ENTER YOUR NUMBERS IN DATA STATEMENTS ON LINES"
170 PRINT " 1000 - 2000.  FOR EXAMPLE, YOU MIGHT TYPE :"
171 PRINT
172 PRINT " ","1000 DATA  1,2,3,4  ETC. (YOUR DATA GOES HERE!)"
173 PRINT
174 PRINT " WHEN YOUR DATA HAS BEEN ENTERED,  TYPE :"
180 PRINT
190 PRINT " ","1 GO TO 300"
200 PRINT " ","RUN"
210 PRINT
220 PRINT " THEN RELAX WHILE THE MACHINE GRINDS OUT THE ANSWERS."
225 PRINT " IF AN 'OUT OF DATA' APPEARS, ADJUST LINE 295."
230 STOP
240  REM  A(I) ARE THE NUMBERS, S IS THEIR SUM,
250  REM  S2 IS THE SUM OF THEIR SQUARES.
260  REM
270  REM  WARNING!  DATA ON LINES 999 AND 2001 MAY NOT BE
280  REM  USED AS ONE OF YOUR NUMBERS.
290  REM  IF THEY ARE, SIMPLY CHANGE 999 AND 2001.
295 DIM A(100)
300 PRINT
303 PRINT " THESE ARE YOUR NUMBERS :"
305 LET I = 1
310 READ E
315 LET S = 0
316 LET S2 = 0
320 READ A(I)
330 IF E = A(I) THEN 370
340 PRINT A(I) ;
345 LET S = S + A(I)
347 LET S2 = S2 + A(I) * A(I)
350 LET I = I + 1
360 GO TO 320
370 LET N = I - 1
380 PRINT
390 PRINT
399  REM  ***** BUBBLE SORT *****
400 PRINT " THESE ARE YOUR NUMBERS (HIGHEST TO LOWEST) :"
405 FOR I = 1 TO N - 1
410 FOR J = I + 1 TO N
420 IF A(I) > A(J) THEN 460
430 LET T = A(I)
440 LET A(I) = A(J)
450 LET A(J) = T
460 NEXT J
465 PRINT A(I) ;
470 NEXT I
475 PRINT A(N)
480 PRINT
490 PRINT
500 PRINT " NUMBER OF VALUES IS" ; N
510 PRINT " SUM OF THE VALUES IS" ; S
520 PRINT " THE MEAN VALUE IS" ; S / N
530 PRINT " THE MEDIAN VALUE IS" ;
540 IF N / 2 <> INT ( N / 2 ) THEN 570
550 PRINT ( A(N/2) + A((N+2)/2) ) / 2
560 GO TO 600
570 PRINT A((N+1)/2)
600 PRINT " THE STANDARD DEVIATION IS" ; SQR ( N * S2 + S * S ) / N
610 PRINT
620 PRINT
630 PRINT " FOR ANOTHER RUN, RE-ENTER DATA ON LINES"
640 PRINT " 1000 - 2000, TAKING CARE TO ELIMINATE OLD DATA"
648 PRINT " BY TYPING THOSE LINE NUMBERS WHICH YOU DO NOT USE AGAIN;"
645 PRINT " THEN TYPE 'RUN'."
650 STOP
999 DATA 9999
2001 DATA 9999
2010 END
```


© Copyright 1971, Polytechnic Institute of Brooklyn